North Carolina Department of Transportation
Statewide Planning Branch
Systems Planning Unit

THOROUGHFARE PLAN TECHNICAL REPORT

November, 1997

Thoroughfare Plan Technical Report
for the

Grifton Urban Area

Prepared by:

Statewide Planning Branch
Division of Highways
North Carolina Department of Transportation

In cooperation with:

Town of Grifton
Federal Highway Administration
US Department of Transportation

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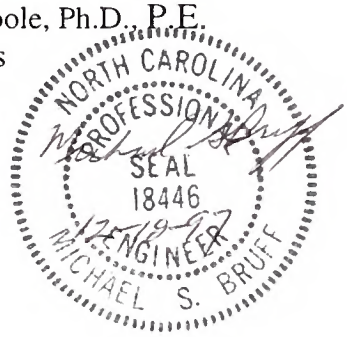

November, 1997

Contents

Executive Summary ..... *i*
Overview ..... *i*
Thoroughfare Planning ..... *i*
Highlights of the Thoroughfare Plan ..... *i*
Implementation ..... *ii*

Chapter 1: Introduction **1**

Chapter 2: Thoroughfare Plan **3**
Thoroughfare Plan Recommendations 3
Major Thoroughfares 3
Minor Thoroughfares 7
Other Projects 7
Construction Priorities and Cost Estimates 8

Chapter 3: Implementation **9**
State-Municipal Adoption of the Plan 9
Corridor Preservation 9
Funding 12

Chapter 4: Trends **13**
Population 15
Economy and Employment 15
Land Use 16

Chapter 5: Travel Demand and Deficiency Analysis **19**
Travel Demand 19
Roadway Capacity 19
Capacity Deficiency Analysis 23
1995 Analysis 23
2020 Analysis 23
High Accident Intersections 23

Chapter 6: Environmental Concerns **25**
Wetlands 25
Threatened and Endangered Species 26
Historic Sites 26
Air and Noise Pollution 29
Other Environmental Concerns 29

Tables

1. Recommended Improvement Priorities and Cost Estimates 8
2. Population Growth 15
3. Road Capacities 20
4. High Accident Locations 24

Figures

1. Grifton Thoroughfare Plan ..... *iii*
2. Recommended Improvements 5
3. Average Daily Traffic Volumes 21
4. Environmental Concerns 27

Appendices

Appendix A: Thoroughfare Plan Street Tabulation

Figure A-1: Typical Thoroughfare Cross Sections ..... A 5
Table A-1: Thoroughfare Plan Street Tabulation and Recommendations ..... A 8

Appendix B: Thoroughfare Planning Principles

Objectives ..... B 1
Operational Efficiency ..... B 2
System Efficiency ..... B 3
Functional Classification ..... B 4
Idealized Major Thoroughfare System ..... B 4
Application of Thoroughfare Planning Principles ..... B 7

Figure B-1: Idealized Thoroughfare Plan ..... B 5

Appendix C: Benefits Analysis

Table C-1: Environmental Considerations ..... C 1
Table C-2: Impact Probability ..... C 2
Table C-3: Benefits Evaluation of Selected Thoroughfare Plan Projects ... C 2

Appendix D: Recommended Definitions and Design Standards for Subdivision Ordinances

Definitions ..... D 1
Design Standards ..... D 3

Table D-1: Minimum Right-of-Way Requirements ..... D 4
Table D-2: Design Speeds ..... D 5
Table D-3: Sight Distance ..... D 6
Table D-4: Superelevation ..... D 6
Table D-5: Maximum Vertical Grade ..... D 7
Table D-6: Exact Metric Equivalents ..... D 9
Table D-7: Exact English Equivalents ..... D 9
Table D-8: NCDOT Metric Roadway Conversions ..... D 9

Appendix E: Level of Service Definitions

Figure E-1: Levels of Service ..... E 3

Appendix F: County and Public Involvement

Meetings ..... F 1
Public Involvement ..... F 2

Executive Summary

Overview

Officials of the Town of Grifton, prompted by a desire to adequately plan for the future transportation needs, requested the North Carolina Department of Transportation's (NCDOT) assistance in updating the 1972 Grifton Thoroughfare Plan. The primary concern of the Board of Commissioners was the potential for increased development due to the North Carolina Global TransPark and how this growth might impact the existing transportation system.

Thoroughfare Planning

The objective of thoroughfare planning is to enable the transportation network to be progressively developed to adequately meet the transportation needs of a community as land develops and traffic volumes increase. By planning now for our future transportation needs, unnecessary costs to the physical, social, and economic environment can be avoided or minimized. Thoroughfare planning is a tool that can be used by local officials to plan for future transportation needs, while at the same time reducing the costs to our environment.

The primary purpose of this report is to present the findings and recommendations of the thoroughfare plan study conducted for the Town of Grifton. The secondary purpose of this report is to document the basic thoroughfare planning principles and procedures used in developing these recommendations. This report is divided into three parts. The first part of the report, Chapter 1, covers the highlights of the study. Chapters 2 and 3 provide a detailed description of the Thoroughfare Plan study recommendations and address different methods by which these recommendations can be implemented. Chapter 4 discusses traffic trends and other issues that affect transportation in the Town. Finally, Chapters 5 and 6 cover the traffic analyses conducted and the environmental concerns considered in the development of the plan.

Further information that will be useful to area planners is provided in the Appendices. The complete Thoroughfare Plan Street Tabulation, including typical cross sections and detailed recommendations, is contained in Appendix A. The principles of thoroughfare planning are covered in Appendix B. The benefit/cost analysis of major projects is included in Appendix C. Recommended definitions and design standards for subdivision ordinances are listed in Appendix D. Appendix E contains definitions of the various levels of service discussed in the report. Finally, Appendix F provides an overview of the involvement of the Town and the general public in the development of the plan.

Highlights of the Thoroughfare Plan

Major highlights of the 1997 Grifton Thoroughfare Plan are outlined on the following page. The Thoroughfare Plan Map is shown in Figure 1.

1. **NC 11**: Widen existing roadway to six lanes.
2. **Northern Loop**: Construct a 2-lane facility on new location connecting North Highland Boulevard (SR 1939) and NC 118 via Casey Drive.
3. **NC 118 Southern Grifton Bypass**: Construct a 2-lane facility on new location just south of the Grifton town limits.
4. **NC 118/SR 1757/South Highland Boulevard**: Widen the existing roadway to five lanes from Queen Street to NC 11.
5. **Queen Street (NC 118)**: Widen and/or re-stripe Queen Street in the downtown area for additional lanes as needed, ultimately widening to four lanes.
6. **Charles Street**: Extend Charles Street east to Dawson Road (SR 1909).
7. **DuPont Avenue**: Extend DuPont Avenue north to the proposed Grifton Northern Loop.
8. **Intersection of Queen Street (NC 118) and Highland Boulevard (SR 1939)**: Widen the turn radius at this intersection to better accommodate truck turning movements.

Implementation

The North Carolina Department of Transportation (NCDOT) and the Town of Grifton are jointly responsible for the proposed thoroughfare improvements. Cooperation between the State and the Town is of primary concern if the recommendations outlined above are to be successfully implemented. The plan has been mutually adopted by both parties, and it is the responsibility of the Town to implement the Plan following the guidelines set forth in Chapter 3 of this report.

It is important to note that the mutually adopted plan is based on anticipated growth within and around the Town of Grifton as indicated by past trends and the anticipated development of the North Carolina Global TransPark. Prior to the construction of each project, a more detailed study will be required to revisit development trends and to determine the specific location and design requirements for each facility.

LEGEND

	EXISTING	PROPOSED
Major Thoroughfare	▬▬	▬ ▬ ▬
Minor Thoroughfare	▬▬	▪ ▪ ▪
Long Range Proposal	▮▮▮▮▮▮▮▮▮	

ADOPTED BY:

TOWN OF GRIFTON	8-12-97
PUBLIC HEARING	8-12-97
PUBLIC INFORMATION WORKSHOP	8-12-97
RECOMMENDED BY STATEWIDE PLANNING	Marion R. Poole 10-3-97
N.C. DEPARTMENT OF TRANSPORTATION	10-3-97

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July 8, 1997

FIGURE 1

THOROUGHFARE PLAN

GRIFTON

Pitt and Lenoir Counties

NORTH CAROLINA

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS - GIS UNIT

UNITED STATES DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

SCALE

0 0.5 1 2 3
Kilometers

0 0.5 1 1.5
miles

Chapter 1
Introduction

A well planned transportation system is an asset to the economic and social well-being of a growing community. It provides the means to transport people and goods from one place to another quickly and conveniently. A good highway system must not only meet existing travel demands, but also keep pace with future development in the region. Thus, this report will identify existing and anticipated transportation problems in the Town of Grifton and recommend a course of action for future development.

Grifton is located along the Pitt County/Lenoir County line. It is served by two major highways: NC 11 along the western side, connecting Greenville and Kinston; and NC 118 directly through town, which provides a connection between NC 11 and US 17. Development in the Town has been slow but steady over the past several years, but is anticipated to increase dramatically with the development of the North Carolina Global TransPark. The TransPark is envisioned to be a major cargo distribution airport, employing people within an hour's commute and attracting increased truck traffic to and from the area. Given Grifton's close proximity to this site, increased residential, commercial, and industrial development is anticipated.

The Grifton Thoroughfare Plan was developed following the principles of thoroughfare planning outlined in Appendix B of this report. Thoroughfares were located based upon existing and anticipated land use and population distribution, topographic and environmental conditions, and field investigations. The plan advocates those improvements that are felt to be essential for proper traffic circulation within the 1995-2020 planning period.

The North Carolina Department of Transportation will be primarily responsible for improvements to major thoroughfares in and around the Town of Grifton, including roads and highways that serve through-traffic and traffic from outside the area to major destinations within the municipality. The Town will be primarily responsible for improvements to the minor thoroughfares which serve internal travel. In addition, the Town of Grifton can greatly contribute to the implementation of this plan by enforcing subdivision and zoning regulations, thus minimizing future impacts to its citizens. The mutually adopted thoroughfare plan will serve as an official guide in the development of an effective thoroughfare system.

Chapter 2
Thoroughfare Plan

A thoroughfare plan identifies existing and anticipated future deficiencies in the transportation system and uncovers the need for new facilities. The thoroughfare plan also provides a representation of the existing highway system by functional use, which includes major thoroughfares, minor thoroughfares, and the local street system. A full description of these various systems is provided in Appendix B.

This chapter presents the thoroughfare plan recommendations. It is the goal of this study to recommend a plan for the transportation system that will serve the anticipated traffic and land development needs of the Town of Grifton over the next 30 years. The primary objective of this plan is to reduce traffic congestion and improve safety by eliminating both existing and anticipated deficiencies in the thoroughfare system. These recommendations are shown in Figure 2.

Thoroughfare Plan Recommendations

MAJOR THOROUGHFARES:

NC 11 - Widen existing roadway to six lanes. Traffic volumes along this road are anticipated to increase significantly as the Global TransPark develops. Currently between 9,200 and 13,000 vehicles per day, these volumes are expected to increase to a high of 40,000 vehicles per day in the year 2020. To accommodate this traffic increase, a six-lane cross-section will be necessary. However, no additional right-of-way will be needed along this route.

Northern Loop - Construct a 2-lane facility on new location. This road will connect NC 118 on the eastern side of Grifton, just west of its intersection with Dawson Road, and North Highland Avenue at its intersection with South Chebistal Drive. Casey Drive will be utilized as part of the loop facility. This road will provide a much needed loop in northern Grifton, connecting the residential development in northeastern Grifton more directly with both NC 118 to the south and NC 11 to the west. It will correct a system deficiency by connecting the radial streets, including NC 118, Dawson Road, Wall Street, Church Street, and Highland Boulevard; shortening many trips; and reducing congestion in the downtown area.

NC 118 Southern Grifton Bypass - This long-range proposal consists of constructing a 2-lane facility on new location just south of the Grifton town limits. This bypass will connect NC 118 on the eastern side of Grifton (near Dawson Road) to NC 11 southwest of Grifton. As the proposed North Carolina Global TransPark develops, NC 118 will be increasingly utilized by truck traffic as a connection between NC 11 and US 17. Currently, NC 118 traverses downtown Grifton, which has several traffic signals, tight turns, and a 20-mph speed limit. In addition, NC 118 is currently routed by an

elementary school. To decrease truck traffic through town, as well as to provide a more direct and efficient through-route for trucks, a bypass is recommended.

NC 118/SR 1757/South Highland Boulevard - Widen the existing roadway to five lanes from Queen Street to NC 11. Traffic volumes on this stretch of NC 118, currently between 4,000 and 5,500 vehicles per day, are increasing toward the practical capacity of a two-lane road. For this reason, additional lanes will be needed within the next 15 years.

Queen Street (NC 118) - Widen and/or re-stripe Queen Street in the downtown area for additional lanes as needed, ultimately widening to four lanes. Currently, Queen Street is a two-lane road with parking on both sides in the downtown area. The high average daily traffic volume, combined with parking and turning movements, contribute to a congested and potentially dangerous road. If the congestion on this road becomes severe, people will start to avoid the downtown area to the detriment of the businesses located there. As the traffic volumes on this road increase, parking on one or both sides will need to be relocated to allow for additional travel lanes. This is the most efficient and cost-effective way of increasing the capacity of this road. If planned for early and effectively, this widening will not cause a great deal of disturbance to the businesses in the area. Plans should be made to reserve lots in the downtown area as they become available to be used as future off-street parking. These additional lanes may also need to be extended east toward the Grifton town limits as development extends in this direction.

North Highland Boulevard (SR 1939) - Minor widening will be needed along this road (see also *Other Projects*). North Highland Boulevard is the primary access for residents of Grifton to NC 11 North. It is a vital link in the local transportation network and should be upgraded to a standard 24-foot roadway.

SR 1091 - Minor widening will be needed along this road during the planning period (see also *Other Projects*). SR 1091 connects Grifton with Snow Hill and other areas to the west. It is used frequently as a trucking route. The Town has requested that this route be signed as a continuation of NC 118 into Greene County. This will be investigated by the Traffic Engineering Branch of the North Carolina Department of Transportation.

Hanrahan Road (SR 1110) - Minor widening will be needed along this road (see also *Other Projects*). This road serves the Weyerhaeuser industrial site north of town and carries a substantial amount of truck traffic. For this reason, improving this roadway to two twelve-foot lanes is recommended.

Church Street/Marvin Taylor Road (SR 1907) - Minor widening will be needed along this road (see also *Other Projects*). This road is a major radial facility in Grifton, connecting the downtown area with residential areas to the northeast. Widening to a standard 24' roadway is recommended.

LEGEND

	Widening	New Location
2 Lanes		
4 Lanes		
5 Lanes		
6 Lanes		

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FIGURE 2

RECOMMENDED IMPROVEMENTS

GRIFTON

Pitt ond Lenoir Counties

NORTH CAROLINA

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS - GIS UNIT

UNITED STATES DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

SCALE

0 0.5 1 2
kilometers

0 0.5 1 1.5
miles

MINOR THOROUGHFARES:

Charles Street Extension - Extend Charles Street east to Dawson Road (SR 1909). This short extension of Charles Street will provide an additional route for residents wishing to travel from NC 118 to the residential areas of northeast Grifton.

DuPont Avenue Extension - Extend DuPont Avenue north to the proposed Grifton Northern Loop along the western side of the railroad tracks. This roadway will act as an additional radial route in the western part of town. It will correct a system deficiency when the Northern Loop is constructed by providing an additional connection between the Loop and the downtown area.

Dawson Road (SR 1909) - Minor widening will be needed along this road (see *Other Projects*).

Main Street - No improvements will be necessary along this roadway in the design period.

McCrae Street - No improvements will be necessary along this roadway in the design period.

Wall Street (SR 1911) - Minor widening will be needed along this road (see *Other Projects*).

OTHER PROJECTS:

Intersection of Highland Boulevard (SR 1939) and Queen Street (NC 118) - Widen the turn radius at this intersection to better accommodate truck turning movements.

Minor widening - Widen sections of the following two-lane roads to 24 feet to meet secondary road standards and for capacity, safety, and driver comfort reasons:

Pitt County:	Lenoir County:
SR 1110, Hanrahan Rd	SR 1091, Old SR 1704
SR 1907, Marvin Taylor Rd	SR 1800, Contentnea Dr
SR 1909, Dawson Rd	SR 1801, Saw Mill Rd
SR 1911, Wall St	SR 1802, Braxton Rd
SR 1939, North Highland Blvd	

Road Paving Projects - A portion of the Highway Trust Fund goes toward the paving of secondary roads throughout the state. As originally written, the Highway Trust Fund Law of 1989 intended to pave all unpaved roads carrying more than 50 vehicles per day by the year 2000, with the balance of roads being paved by 2006. While this time

frame has been altered slightly due to a revenue shortfall, the basic goals of the program are still in place.

Construction Priorities and Cost Estimates

Construction priorities vary depending on the criteria considered and the weight attached to these criteria. Most people would agree that improvements to the major thoroughfare system and major traffic routes are more important than improvements to minor thoroughfares where traffic volumes are lower. To be included in the North Carolina Transportation Improvement Program (TIP), a project must show favorable benefits relative to cost and should not be prohibitively disruptive to the environment. Thus, to help the State and the Town in their efforts to implement the thoroughfare plan, the major projects have been placed in order of priority based on benefit/cost comparisons. The results of this analysis are shown below in Table 1. A discussion of the benefit/cost analysis and the computations for the major projects in the Town of Grifton are included in Appendix C.

Table 1

Recommended Improvement Priorities and Cost Estimates for Major Projects	
Project	**Cost (millions)**
1st Priority -- 1997-2005	
Widening of Turn Radius at NC 118/Queen Street and SR 1939	$ 0.5
N Highland Blvd Widening to Standard 2-lane Cross Section	$ 1.4
2nd Priority -- 2005-2015	
Grifton Northern Loop, NC 118 to N Highland Blvd (SR 1939)	$ 3.4
NC 118/South Highland Blvd Widening, Contentnea Dr to Queen St	$ 3.6
NC 118/Queen Street Widening, Highland Blvd to E Town Limit	$ 3.6
3rd Priority – 2015-2025	
NC 11 Widening to 6 lanes	$ 22.4
NC 118/SR 1757/S Highland Widening, NC 11 to Contentnea Dr	$ 3.0
NC 118 Grifton Southern Bypass	$ 9.2

Chapter 3
Implementation

Implementation is one of the most important aspects of the transportation plan. Unless implementation is an integral part of the process, the effort and expense associated with developing the plan is lost. There are several tools available for use by the Town of Grifton to assist in the implementation of the thoroughfare plan. These tools are described below.

State-Municipal Adoption of Thoroughfare Plan

The first step in the implementation process is the mutual adoption of the thoroughfare plan, as shown in Figure 1, by the Town of Grifton and the North Carolina Department of Transportation. The mutually approved plan may then serve as a guide for the Town and the Department of Transportation in the development of the area road and highway system. The adoption of the plan by the Town also enables standard road regulations and land use controls to be used effectively in the implementation of this plan.

Corridor Preservation

The next step in implementing the thoroughfare plan is corridor preservation. Corridor preservation is a critical step in the implementation process because it minimizes the disruption of future road construction on the local residents and businesses, as well as on the environment. Through measures such as subdivision, land use, and development regulations, the Town can protect the necessary rights-of-way for the recommended improvements.

Subdivision Controls

Subdivision regulations require every subdivider to submit to the Town Planning Commission a plan of any proposed subdivision. They also require that subdivisions be constructed to certain standards. Through this process, it is possible to require the subdivision streets to conform to the thoroughfare plan and to reserve or protect necessary rights-of-way for projected roads and highways that are to become a part of the thoroughfare plan.

This tool would be applicable to the construction of any new facilities, such as the proposed Northern Loop and the NC 118 Southern Bypass. Ensuring that subdividers include planned transportation facilities in their designs can help reduce highway construction costs and possible disruption to future homes and businesses.

Land Use Controls

Land use regulations are an important tool in that they regulate future land development and minimize undesirable development along roads and highways. The land use regulatory system can improve highway safety by requiring

sufficient setbacks to provide for adequate sight distances and by requiring off-street parking.

This tool would be applicable to facilities that are recommended to be widened to multiple lanes, such as South Highland Boulevard. Land use controls can help to ensure that these facilities will maintain their intended capacities by regulating the types of land use that develop along the roads.

Development Reviews

Driveway access to a State-maintained street or highway is reviewed by the District Engineer's office and by the Traffic Engineering Branch of the North Carolina Department of Transportation. In addition, any development expected to generate large volumes of traffic (e.g., shopping centers, fast food restaurants, or large industries) may be comprehensively studied by staff from the Traffic Engineering Branch, Statewide Planning Branch, and/or Roadway Design Unit of NCDOT. If done at an early stage, it is often possible to significantly improve the development's accessibility while preserving the integrity of the thoroughfare plan. Since the County is the first point of contact for developers, it is important that the County advise developers of this review requirement and cooperate in the review process.

It is anticipated that portions of NC 118 and North and South Highland Boulevard will experience increased development throughout the planning period. Use of development regulations can help control increasing traffic and congestion along these roads.

Zoning Ordinances

A zoning ordinance can be beneficial to thoroughfare planning by designating appropriate locations for various land uses and allowable densities for residential development. This provides a degree of stability on which to make future traffic projections and to plan streets and highways. Other benefits of a good zoning ordinance include the establishment of standards of development, which will aid traffic operations on major thoroughfares, and the minimization of strip commercial development, which creates traffic friction and increases the traffic accident potential.

The Town's zoning ordinances should be structured to control strip development along the thoroughfares. Allowing this type of development without strict zoning controls will increase traffic congestion on these facilities.

Future Street Lines

The Future Street Line Ordinance is beneficial where the widening of a street will be necessary at some time in the future. A municipality, with legislative approval, may amend its charter to be empowered to adopt future street line ordinances.

Through a metes-and-bounds description of a street's future right-of-way requirements, the Town may prohibit new construction or reconstruction of structures within the future right-of-way. This approach requires the specific design of a facility and would usually require surveys and public hearings to let affected property owners to know what to expect and to allow them to make necessary adjustments without undue hardships. One ordinance can be enacted for several streets.

This tool could be used on multi-lane widening projects such as South Highland Boulevard when development pressure becomes more intense.

Capital Improvements Program

One of the tools which makes it easier to build a planned thoroughfare system is a Capital Improvements Program. This is a long range budget for street improvements, acquisition of right-of-way, and other capital improvements on the basis of projected revenues. Municipal funds should be available for: construction of street improvements which are a municipal responsibility; right-of-way cost-sharing on facilities designated a Division of Highways responsibility; and advance purchase of right-of-way where such action is warranted.

Historically, cities and towns have depended a great deal on Federal or State funding to solve their transportation problems. Chapter 136, Article 3A, of the Road and Highway Laws of North Carolina, passed in 1988, limits the role of municipalities in right-of-way cost sharing. However, set-back regulations, right-of-way dedications, and reservations can also play a major role in reducing the ultimate cost of many facilities. Only in special cases will the municipality be able to enjoy the benefits of highway improvement without some form of investment.

Official Maps

As adopted by the legislative body of the community, a Roadway Corridor Official Map (or Official Street Map) can pinpoint and preserve the location of proposed streets against encroachment. In effect, the official map serves notice on developers that the State or municipality intends to acquire certain property. The official map serves as a positive influence for sound development by reserving sites for public improvements in anticipation of actual need.

The North Carolina Department of Transportation (NCDOT) limits its use of official maps to large scale, fully access controlled facilities planned for rapidly developing areas outside of municipal jurisdictions. For projects within municipal jurisdictions, official maps should be prepared and adopted by the local government. Municipalities may adopt official maps that extend beyond their extraterritorial jurisdictions with approval from the Board of Commissioners.

It should be recognized that an official map places severe but temporary restrictions on private property rights. These restrictions are in the form of a prohibition, for up to three years, on the issuance of building permits or the approval of subdivisions on property lying within an official map alignment. The three-year reservation period begins with the request for development approval. This authority should be used carefully and only in cases where less restrictive powers are found to be ineffective.

The Program Development Branch of the North Carolina Department of Transportation is responsible for facilitating the adoption of Official Street Maps. For a copy of the "Guidelines for Municipalities Considering Adoption of Roadway Corridor Maps," contact:

NC Department of Transportation
Program Development Branch
Post Office Box 25210
Raleigh, NC 27611

Urban Renewal

Urban renewal plays a minor role in the transportation planning implementation process in terms of scope and general influence. However, under the right circumstances, renewal programs can make significant contributions. Provisions of the New Housing Act of 1974 (as amended) call for the conservation of slum areas. In the course of renewal, it is important to coordinate with the thoroughfare plan to see if additional set-backs or dedication of rights-of-way are needed.

Continued use of urban renewal programs to improve the transportation system is encouraged. Changes that can be made under this program are generally not controversial or disruptive compared to the clearance of a significant area.

Funding

The final step in the implementation process is to obtain funding for each project. Sources such as the Transportation Improvement Program, small urban funds, enhancement funds, and industrial access funds are a few examples of funding sources available to the County.

Transportation Improvement Program

North Carolina's Transportation Improvement Program (TIP) is a document which lists major construction projects the Department plans for the next seven years. TIP projects are matched with project funding sources. Each year when the TIP is updated, completed projects are removed, programmed projects are advanced, and new projects are added.

Annual TIP public hearings are held each October and November. At these public hearings, municipalities, county governments, the general public, and others request projects to be included in the TIP. A Board of Transportation Member reviews all of the project requests in his or her division. Based on technical feasibility, need, and available funding, the Board Member decides which projects will be included in the TIP. In addition to highway construction and widening, TIP funds are also available for other projects including bridge replacement, highway safety, public transit, railroad crossings, and bicycle facilities.

Small Urban Funds

Small Urban Funds are discretionary funds available to each of the 14 divisions on an annual basis. Each division receives $1 million per year. The Board Member uses this money to fund projects at his or her discretion. These funds are available for the construction of projects occurring within the city limits or within one mile of the municipal boundaries. Request for Small Urban Fund assistance should be directed to the appropriate Board Member and Division Engineer.

Enhancement Funds

The Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991 provides federal funds for transportation enhancement activities. These activities must have a direct relationship to the intermodal transportation system. This relationship may be one of function, proximity, or impact. Activities that may be eligible for these funds include: pedestrian and bicycle facilities; acquisition of scenic easements and scenic or historic sites; scenic or historic highway programs; landscaping and other scenic beautification; historic preservation; rehabilitating and operating historic transportation buildings, structures, or facilities; preserving abandoned railway corridors; controlling and removing outdoor advertising; archaeological planning and research; and mitigating water pollution due to highway runoff. For additional information concerning these funds, contact the Program Development Branch of the NC Department of Transportation.

Industrial Access Funds

Industrial Access funds are used by the Department to finance both new highway construction and improvements to existing roads or bridges as an incentive to develop industrial interests. For example, if an industry wishes to develop property that does not have access to a state maintained highway and certain economic conditions are met, then funds may be available for construction of an access road. For additional information concerning these funds, contact the Program Development Branch of the NC Department of Transportation.

Other Funding Sources

1. Assess user impact fees to fund transportation projects. These fees, called "facility fees" in the legislation, are to be based upon "reasonable and uniform considerations of capital costs to be incurred by the town as a result of new

construction. The facility fee must bear a direct relationship to additional or expanded public capital costs of the community service facilities to be rendered for the inhabitants, occupants of the new construction, or those associated with the development process."

2. Enact a bond issue to fund street improvements.
3. Consider the possibility of specific projects qualifying for federal demonstration project funds.
4. Adopt a collector street plan that would assess buyers or property owners for street improvement.
5. Charge a special assessment for utilities; for example, increase water and sewer bills to cover the cost of street improvements.
6. Apply for grants and loans for public works and development facilities from Federal agencies for uses such as small business development.

Chapter 4
Trends

The primary objective of thoroughfare planning is to develop a transportation system that will meet future travel demand and enable people and goods to travel safely and economically. To determine the needs of an area, it is important to understand the role of population, the economy, land use, and vehicle registration and use.

Population

The amount of traffic on a section of road is a function of the size and location of the population it serves. Investigating past trends in population growth and forecasting future population growth and dispersion is one of the first steps for a transportation planner. Table 2 shows population trends and forecasts for the Town of Grifton, Grifton and Contentnea Neck Townships, and Pitt and Lenoir Counties. This information illustrates the steady growth that is taking place in the area that is anticipated to continue well into the next century.

Table 2A

Population Growth						
Year	Grifton	Growth	Grifton Township	Growth	Contentnea Neck Twp.	Growth
1970	1,860	---	3,552	---	2,806	---
1980	2,179	+ 17.2%	3,358	- 5.5%	2,981	+ 6.2%
1990	2,393	+ 9.8%	4,045	+ 20.5%	2,824	- 5.3%

Table 2B

Population Growth				
Year	Pitt County	Growth	Lenoir County	Growth
1970	73,900	---	55,204	---
1980	90,146	+ 22.0%	59,819	+ 8.4%
1990	108,480	+ 20.3%	57,274	- 4.3%
* 2000	126,546	+ 16.7%	60,290	+ 5.3%
* 2010	146,068	+ 15.4%	59,652	- 1.1%
* 2020	165,467	+ 13.3%	58,394	- 2.1%

* Projections from Office of State Budget and Management, Demographics Unit
Note: These projections are based on trends in birth rates, death rates, and migration rates. They do not account for economic variables, such as the impending development of the Global TransPark, which will have a tremendous effect on population counts in the area.

Economy and Employment

One of the more important factors to be considered in estimating the future traffic growth of an area is its economic base. The number of persons residing in any given area is

directly related to the number of jobs available in that area. For example, a decision by a large firm to build an industrial plant employing several hundred people would have an abrupt impact on an area's economy, providing a new incentive for people to move into that area. Secondary spin-offs of such a decision would include: an increased demand for new housing and services; increased retail sales and bank deposits; increased school enrollment; increased traffic; and several other benefits and costs associated with urban growth.

The development of the North Carolina Global TransPark is expected to be the single most influential economic occurrence for the Town of Grifton over the next several decades. The Global TransPark is a proposed industrial/airport complex designed for "just-in-time" business operations. The TransPark is being developed on the existing site of the Kinston Regional Jetport in Lenoir County. It is expected to employ 3,600 people by the year 2000, and 25,000 people by the year 2020. Additional induced and indirect employment in the area and in surrounding counties is also expected to be generated by the TransPark's existence.

In the Grifton area, increased residential development is expected to occur as people take jobs in the TransPark complex. Grifton is expected to serve as a "bedroom community" to the TransPark and, as such, will experience increases in service-related businesses, such as grocery stores, fast food restaurants, and other industries which cater to personal business.

The transportation infrastructure to serve the Global TransPark will utilize existing highway corridors, including NC 11 and NC 118, with improvements made as needed. Access for commuters traveling into, out of, and through Grifton will be a primary concern as TransPark development progresses. In addition, increased trucking movements on NC 11 and NC 118 through the area will need to be accommodated.

It is anticipated that the projects proposed on the thoroughfare plan will satisfy the anticipated travel demands over the next 25 years. However, as circumstances change and the TransPark begins to develop more rapidly, these recommendations can be reevaluated and modified as necessary.

Land Use

The generation of traffic on a particular thoroughfare is closely related to the use of adjacent land areas. Some types of land uses generate much more traffic than others. For example, a commercial or retail area, such as a shopping center, will generate (or attract) much larger volumes of traffic than a residential area. The attraction between different land uses varies with the intensity of development and the distance between those developed areas. Therefore, it becomes necessary to designate land uses by type for transportation planning.

Typically in transportation planning, land uses are grouped into four categories:

1. Residential - all land devoted to the housing of people (excluding hotels and motels);
2. Commercial - all land devoted to retail trade, including consumer and business services and offices;
3. Industrial - all land devoted to manufacturing, storage, warehousing, and transportation of products; and
4. Public - all land devoted to social, religious, educational, cultural, and political activities.

An analysis of the existing land use distribution serves as a basis for forecasting future land use needs and the resulting travel patterns. Thus, determining where growth will occur within the planning area facilitates the location of proposed thoroughfares and improvements to existing thoroughfares.

The majority of growth expected in Grifton is residential. The areas expected to experience this growth are located in northern Grifton, along North Highland Boulevard (SR 1939) and Church Street/Marvin Taylor Road (SR 1907), and in southwest Grifton, west of NC 11. The transportation system must be able to efficiently and effectively accommodate the commuting patterns of these new residents to and from their work sites, which will be primarily outside the town. As mentioned previously, these new residents will increase the demand for service-related businesses within Grifton, so improvements to roads within town will also be necessary.

In addition, as the Global TransPark develops, increased commercial development catering to trucking needs can be expected along NC 11 south of town and NC 118 east of town. These two areas are expected to be key development areas because NC 11 and NC 118 provide quick access for shipments to and from US 17 and eastern North Carolina.

Chapter 5
Travel Demand and Deficiency Analysis

This chapter presents an analysis of the ability of the existing street system to serve the area's travel desires. Emphasis is placed not only on detecting the deficiencies, but on understanding their causes. Travel deficiencies may be localized, resulting from a substandard highway design, inadequate pavement width, or intersection controls. Alternately, the underlying problem may be caused by a system deficiency, such as a need for a bypass, loop facility, additional radials, or construction of missing links.

An analysis of the roadway system must first look at existing travel patterns and identify existing deficiencies. This includes roadway capacity and safety analysis. After the existing picture of travel in the area has been developed, the engineer analyzes factors that will impact the future system. These factors include forecast population growth, economic development potential, and land use trends. This information is used to determine future deficiencies in the transportation system.

Travel Demand

The existing major street system can be evaluated by comparing traffic volumes with the ability of the streets to move traffic freely and at a desirable speed. A street's ability to move traffic is usually controlled by the spacing of major intersections, width of pavement, restriction of parking and turning movements, and signalization.

Average annual daily traffic volumes (AADT) for 1995 on selected major roads and highways in the Town of Grifton are shown in Figure 3. Also shown are projections for the year 2020, assuming no changes to the existing street system are made. These projections were based on historic and anticipated population, economic growth patterns, and land use trends.

Roadway Capacity

Although minimum requirements are necessary for all roads serving the public, the ultimate design of a road will vary according to the desired capacity and level-of-service to be provided. Universal standards in the design of thoroughfares are not practical. Each road or highway section must be individually analyzed and its design requirements determined by the amount and type of projected traffic, existing capacity, desired level of service, and available right-of-way.

Many different factors contribute to the capacity of a roadway. These factors include:

1. Geometrics of the road, including:
    - number of lanes
    - horizontal and vertical alignment
    - proximity of perceived obstructions to safe travel along the road

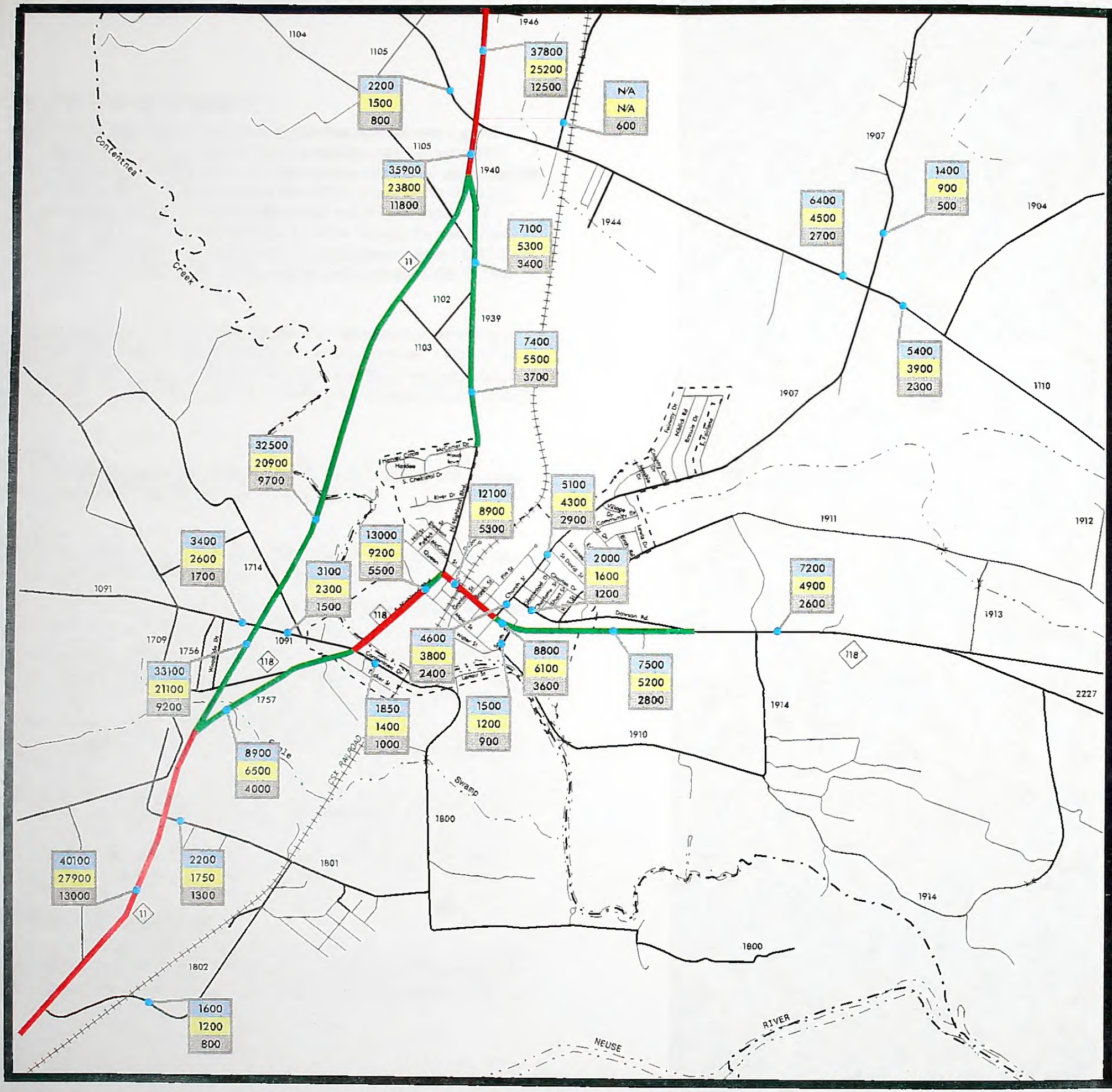
2. Typical users of the road, such as:
    - commuters
    - recreational travelers
    - truck traffic
3. Access control (including streets and driveways), or lack thereof, along the road;
4. Development along the road, including:
    - residential
    - commercial
    - industrial
5. Number of traffic signals along the route;
6. Peaking characteristics of the traffic on the road --
    - rural roads tend to have a higher morning and afternoon peak period increase in traffic as compared to mid-day traffic;
7. Characteristics of side-roads feeding into the road; and
8. Directional split of traffic, or the percentage of vehicles traveling in each direction along a road at any given time.

Because of these many factors, and due to the changing nature of roads and their surroundings as time progresses, it is very difficult to determine an exact point at which a road reaches its capacity. At the thoroughfare planning level, the capacity of a road is estimated using the factors above and comparing them to other roads in the state with similar, but more progressed, circumstances. Table 3 shows approximate capacities for various type of roadways in settings with different intensities of surrounding development. These capacities are measured in vehicles per day. Roads in Grifton that are projected to be over capacity by the year 2020 are shown in red on Figure 3, while those expected to be near capacity are shown in green.

Table 3

Road Capacities (vehicles per day)			
Development >>>	**High Intensity**	**Medium Intensity**	**Low Intensity**
2-lane road	8,000	10,000	12,000
3-lane road	12-16,000	15-18,000	20,000
4-lane road:			
undivided	18-22,000	30-35,000	45,000
divided	18-22,000	35-40,000	48,000
5-lane road	24-28,000	32-38,000	47,000
4-lane freeway		54,000	
6-lane freeway		81,000	

- Above capacities assume 3.6 m (12') lanes, 5% trucks, a 60/40 directional split of traffic, level of service D.
- *Low intensity* locations assume sparse rural development and uninterrupted flow on the roadway.
- *Medium intensity* locations assume typical suburban-type development with approximately 2 signals per mile and less than 10 other intersections per mile.
- *High intensity* locations assume dense urban development with closely spaced traffic signals and no street or driveway access control.



LEGEND

OVER CAPACITY IN 2020

NEAR CAPACITY IN 2020

2020 AVERAGE DAILY TRAFFIC	00000
2010 AVERAGE DAILY TRAFFIC	00000
1995 AVERAGE DAILY TRAFFIC	00000

Traffic projections based on currently anticipated development of the North Carolina Global Transpark

FIGURE 3

AVERAGE DAILY TRAFFIC ON EXISTING ROAD NETWORK

GRIFTON

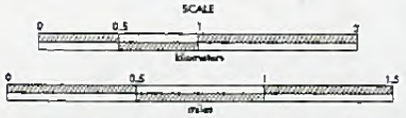
Pitt and Lenoir Counties

NORTH CAROLINA

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS - GIS UNIT

UNITED STATES DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

SCALE



Capacity Deficiency Analysis

Capacity is defined as the maximum number of vehicles that can pass over a given section of roadway during a given time period under prevailing roadway and traffic conditions. The relationship of traffic volumes to the capacity of the road determines the level of service being provided. The level of service (LOS) is a qualitative measure describing the operating conditions within a traffic stream and their perception by motorists and/or passengers. Six levels of service are used to identify the conditions existing along a highway or street. They are given letter designations, from LOS "A" to LOS "F," with LOS "A" representing the best operating conditions and LOS "F," the worst.

The recommended improvements in the thoroughfare plan were based on achieving a minimum LOS "D" on existing facilities and LOS "C" on new facilities. LOS "D" is considered the "practical capacity" of a facility, or that point at which the public begins to express dissatisfaction. These levels of service are defined and illustrated in Appendix E of this report.

1995 Analysis

The comparison of 1995 average daily traffic volumes in the Grifton area with existing road capacities indicates that no roads are currently over capacity.

2020 Analysis

During the planning period from 1995 to 2020, portions of several major facilities are expected to near or exceed their practical capacities. These include:

- NC 11 – anticipated increases in traffic due to the development of the Global TransPark will necessitate additional lanes along this route;
- South Highland Boulevard (NC 118/SR 1939) – commuting traffic from expected residential developments, along with increased truck traffic bound for the TransPark, will cause the capacity of this facility to be exceeded;
- Queen Street (NC 118) – traffic increases along NC 118 will overload this facility through downtown if no improvements to the area transportation system are made;
- North Highland Boulevard (SR 1939) – traffic is expected to approach the capacity of this route north of town due to its sub-standard two-lane width.

These deficiencies have been addressed through this thoroughfare planning process. Complete recommendations for these facilities are included in Chapter 2 of this report.

High Accident Intersections

Traffic accidents are often used as an indicator for locating congestion problems. Traffic accident records can be reviewed to identify deficiencies such as poor design, inadequate signing, ineffective parking, or poor sight distance. Accident patterns developed from the

analysis of accident data can lead to improvements that will reduce the number of accidents.

Table 4 provides a summary of the accidents occurring in the Grifton area for the three year period from January, 1994, through December, 1996. This table only includes locations with 3 or more accidents. Both the number and severity of accidents are considered when investigating accident data.

The NCDOT Division is actively involved with investigating and improving many of these locations. To request a more detailed analysis for any of the intersections listed below, or other intersections of concern, the town should contact the Division Traffic Engineer.

Table 4

High Accident Locations

Location	# of Accidents	# of Injuries	Severity Code * F	A	B	C	Predominant Type
NC 11 / SR 1110 (Hanrahan Rd)	7	5				5	Angle
NC 11 / SR 1939 (North Highland Blvd)	3	5			1	4	Various
NC 118 (Queen St) / SR 1939 (Highland Blvd)	4	1			1		Turning Moves
NC 118 (Queen St) / Gordon Street	3	0					Ran off Road
SR 1110 (Hanrahan Rd) / SR 1900 (Weyerhaeuser Rd)	4	4		3		1	Various
SR 1110 (Hanrahan Rd) / SR 1904 (White Lane Rd)	3	2			1	1	Ran off Road
SR 1939 (South Highland Blvd) / Main Street	3	5				5	Various

Key to Severity Codes:

- F - Fatality
- A - Class "A" Injury - Incapacitating. The injury is obvious and severe enough to prevent carrying on normal activities for at least 24 hours; e.g., massive loss of blood or broken bone.
- B - Class "B" Injury - Non-incapacitating. In this case, an injury other than a fatality or Class "A" injury is evident.
- C - Class "C" Injury - No visible sign of injury, but complaint of pain or momentary loss of consciousness occurs.

Chapter 6
Environmental Concerns

In the past several years, environmental concerns associated with highway construction have come to the forefront of the planning process. The legislation that dictates the necessary procedures regarding environmental impacts is the National Environmental Policy Act. Section 102 of this act requires the execution of an environmental impact statement (EIS) for road projects that have a significant impact on the environment. Included in an EIS are the project's impact on wetlands, water quality, historic properties, wildlife, and public lands. While this report does not cover the environmental concerns in as much detail as an EIS would, preliminary research was done on several of these factors and is included below. (See Figure 4 for environmental data.)

Wetlands[1]

Wetlands are lands where saturation with water is the dominant factor in determining the nature of soil development and the types of plant and animal communities living in the soil and on its surface. The single feature that most wetlands share is soil or substrate that is at least periodically saturated with or covered by water. The water creates severe physiological problems for all plants and animals except those that are adapted for life in water or in saturated soil.

Wetlands are crucial ecosystems in our environment. They help regulate and maintain the hydrology of our rivers, lakes, and streams by slowly storing and releasing flood waters. They help maintain the quality of our water by storing nutrients, reducing sediment loads, and reducing erosion. They are also critical to fish and wildlife populations. Wetlands provide an important habitat for about one third of the plant and animal species that are Federally listed as threatened or endangered.

In this study, the impacts to wetlands were determined using the National Wetlands Inventory Mapping provided by the U.S. Fish and Wildlife Service. It is important to note that this mapping is an approximation of the location of wetlands. These maps are based on aerial photographs and have not been field checked. Prior to the design of a facility, a more extensive investigation will be necessary.

The location of wetlands in the Grifton area is shown in Figure 4. Wetland impacts have been avoided or minimized to the greatest extent possible while preserving the integrity of the thoroughfare plan. As shown, there will most likely be impacts to wetlands in the construction of the NC 118 Southern Grifton Bypass across Contentnea Creek and minimal impacts in the construction of the Grifton Northern Loop. (See Chapter 2 for a complete description of these projects.)

[1] from: Dahl, T.E. and C.E. Johnson, *Status and Trends of Wetlands in the Conterminous United States, Mid-1970's to Mid-1980's*. U.S. Department of the Interior, Fish and Wildlife Service, Washington, D.C., 1991.

Threatened and Endangered Species

A preliminary review of the Federally Listed Threatened and Endangered Species within the Grifton area was done to determine the effects that new corridors could have on the wildlife. These species were identified using mapping from the North Carolina Department of Environment and Natural Resources.

The Threatened and Endangered Species Act of 1973 allows the U. S. Fish and Wildlife Service to impose measures on the Department of Transportation to mitigate the environmental impacts of a road project on endangered plants and animals and critical wildlife habitats. By locating rare species in the planning stage of road construction, we are able to avoid or minimize these impacts.

There are no known occurrences of federally listed threatened or endangered species in the Grifton area. However, three occurrences of the Neuse River Waterdog have occurred within a two-mile radius of the proposed NC 118 Southern Bypass, which will cross Contentnea Creek. The waterdog is a salamander endemic to North Carolina and found in rivers and large streams in the Neuse and Tar River drainage areas. This species is a State Special Concern amphibian, and a drop in water quality could effectuate declines in its population and/or species diversity. It has been recommended that Best Management Practices, as listed by the US Corps of Engineers, be followed when constructing this project.

Other threatened or endangered species that have been identified in the Pitt/Lenoir County area include the Bald Eagle, Red-cockaded Woodpecker, Manatee, Tar Spinymussel, and Virginia Jointvetch. These and other rare plant and animal species should be investigated further through environmental field surveys before any construction is done.

Historic Sites

The location of historic sites was investigated to determine the possible impacts of the various projects studied. The federal government has issued guidelines requiring all State Transportation Departments to make special efforts to preserve historic sites. In addition, the State of North Carolina has issued its own guidelines for the preservation of historic sites. These two pieces of legislation are described below:

National Historic Preservation Act - Section 106 of this act requires the Department of Transportation to identify historic properties listed in the National Register of Historic Places and properties eligible to be listed. The DOT must consider the impact of its road projects on these properties and consult with the Federal Advisory Council on Historic Preservation.

NC General Statute 121-12(a) - This statute requires the DOT to identify historic properties listed on the National Register, but not necessarily those

Legend

County Boundary
- County Boundary
- State Boundary
- NPDES - Point Source Dischargers
- Groundwater Incidents
- Railroad Crossings
- Roads

Roads (Primary Routes)
- Interstate
- U.S.
- N.C.
- Blue Ridge Parkway
- Railroads
- Major Transmission Lines
- Anadromous Fish Spawning Areas
- Hydro - Rivers/Streams
- Hydro - Water Bodies
- Hydro - Major Rivers/Streams
- Hydro - Major Water Bodies
- Land & Water Conservation Fund
- National Wetlands Inventory
- NWI
- Municipal Boundaries

N

Figure 4

Environmental Issues
Grifton, North Carolina

North Carolina Department of Transportation
Division of Highways
Statewide Planning Branch

0.5 0 0.5 1 1.5 Miles

eligible to be listed. DOT must consider impacts and consult with the North Carolina Historical Commission, but it is not bound by their recommendations.

There are currently no properties in the Grifton area listed on the National Register of Historic Places or on its Study List. However, care should be taken to make certain that potentially historic sites and natural settings are preserved. Therefore, a closer study should be done in regard to local historic sites prior to the construction of any proposal.

Air and Noise Pollution

The design of a thoroughfare system can have a significant effect on the amount of pollutants added to the atmosphere. Pollutant emissions are reduced when traffic is permitted to flow smoothly and by the reduction of congestion and stop-and-go conditions. This reduction of pollutants is created by the more efficient use of fuel offered by free flow conditions.

The control of noise pollution in the vicinity of residential neighborhoods is another important aspect of transportation planning. By designating certain routes as thoroughfares, we are able to direct the heaviest flows of traffic through areas that are amenable to or even desire such traffic. This reduces the noise from automobile and truck traffic in areas where quieter surroundings are desired.

NC 118/Queen Street through the downtown area will see a reduction is truck traffic and some through traffic and, thus, will experience decreases in noise and air pollution in this area once the Southern Grifton Bypass is completed. The reduction in noise will be a welcome relief to the students and teachers at the elementary school on Queen Street.

Increases in noise and air pollution will be experienced on most major routes in the area, including NC 11 and NC 118 east of town, due to the anticipated increases in development and traffic with ties to the Global TransPark. These increases are typical and are to be expected as development occurs in any area.

Other Environmental Concerns

There is one additional environmental factor that must be considered in regard to the NC 118 Southern Grifton Bypass. Contentnea Creek is an anadromous fish spawning area. Anadromous fish live in salt water, but swim upstream to fresh water areas to spawn. Typically, a moratorium on construction in these areas is recommended between January and May of each year so as not to hinder the spawning process.

APPENDIX A

Appendix A
Thoroughfare Plan Street Tabulation and Recommendations

This appendix includes a detailed tabulation of all roads identified as elements of the Grifton Thoroughfare Plan. Table A-1 includes a description of each road section, as well as the length, cross-section, and right-of-way for each section. Also included are existing and projected average daily traffic volumes, roadway capacities, and the recommended lane configuration.

The following index of abbreviations may be helpful in interpreting the table:

- A through P - Codes referring to the typical cross sections below
- ADQ - Adequate
- ADT - Average Daily Traffic
- CL - City Limits
- DIST - Distance along Route
- -L - Number of Lanes
- -LD - Number of Lanes, Divided Cross Section
- -LP - Number of Lanes, with on-street Parking
- N--, S--, E--, W-- - North, South, East, West
- N/A - Not Available
- PB - Planning Boundary
- RDWY - Roadway Width
- ROW - Right of Way Width
- SR - Secondary Road
- UNK - Unknown
- VPD - Vehicles per Day

Typical Cross Sections

Cross section requirements for thoroughfares vary according to the desired capacity and level of service to be provided. Universal standards in design of thoroughfares are not practical. Each section of road must be individually analyzed and its cross section requirements determined on the basis of amount and type of projected traffic, existing capacity, desired level of service, and available right-of-way. Typical cross sections recommended by the Statewide Planning Branch are shown in Figure A-1. These cross sections are typical for facilities at new locations and where right-of-way constraints are not critical. For widening projects and urban projects with limited right-of-way, special cross-sections should be developed that meet the needs of the project.

The recommended typical cross sections shown in Table A-1 were derived on the basis of projected traffic, existing capacities, desirable levels of service, and available right-of-way.

A - Four Lanes Divided with Median, Freeway
This cross section is typical for four-lane divided highways in rural areas which may have only partial or no control of access. The minimum median width for this cross section is 14 m (46 feet), but a wider median is desirable.

B - Seven Lanes, Curb & Gutter
This cross section is not recommended for new projects. When the conditions warrant six lanes, cross section "D" should be recommended. Cross section "B" should be used only in special situations such as widening from a five lane section when right-of-way is limited. Even in these situations, consideration should be given to converting the center turn lane to a median so that cross section "D" is the final cross section.

C - Five Lanes, Curb & Gutter
Typical for major thoroughfares, this cross section is desirable where frequent left turns are anticipated as a result of abutting development or frequent street intersections.

D - Six Lanes Divided with Raised Median, Curb & Gutter
E - Four Lanes Divided with Raised Median, Curb & Gutter
These cross sections are typically used on major thoroughfares where left turns and intersection streets are not as frequent. Left turns would be restricted to a few selected intersections. The 4.8 m (16 ft) median is the minimum recommended for an urban boulevard type cross section. In most instances, monolithic construction should be utilized due to greater cost effectiveness, ease and speed of placement, and reduced future maintenance requirements. In special cases, grassed or landscaped medians may be used in urban areas. However, these types of medians result in greatly increased maintenance costs and an increased danger to maintenance personnel. Non-monolithic medians should only be recommended when the above concerns are addressed.

F - Four Lanes Divided, Boulevard, Grass Median
Recommended for urban boulevards or parkways to enhance the urban environment and to improve the compatibility of major thoroughfares with residential areas. A minimum median width of 7.3 m (24 ft) is recommended with 9.1 m (30 ft) being desirable.

G - Four Lanes, Curb & Gutter
This cross section is recommended for major thoroughfares where projected travel indicates a need for four travel lanes but traffic is not excessively high, left turning movements are light, and right-of-way is restricted. An additional left turn lane would probably be required at major intersections. This cross section should be used only if the above criteria is met. If right-of-way is not restricted, future strip development could take place and the inner lanes could become de facto left turn lanes.

H - Three Lanes, Curb & Gutter
In urban environments, thoroughfares which are proposed to function as one-way traffic carriers would typically require this cross section.

I - Two Lanes, Curb & Gutter with Parking on Both Sides
J - Two Lanes, Curb & Gutter with Parking on One Side

Cross sections "I" and "J" are usually recommended for urban minor thoroughfares since these facilities usually serve both land service and traffic service functions. Cross section "I" would be used on those minor thoroughfares where parking on both sides is needed as a result of more intense development.

K - Two Lanes, Paved Shoulder

This cross section is used in rural areas or for staged construction of a wider multi-lane cross section. On some thoroughfares, projected traffic volumes may indicate that two travel lanes will adequately serve travel for a considerable period of time. For areas that are growing and future widening will be necessary, the full right-of-way of 30 m (100 ft) should be required. In some instances, local ordinances may not allow the full 30 m. In those cases, 21 m (70 ft) should be preserved with the understanding that the full 30 m will be reserved by use of building setbacks and future street line ordinances.

L - Six Lanes Divided with Grass Median, Freeway

Cross section "L" is typical for controlled access freeways. The 14 m (46 ft) grassed median is the minimum desirable median width, but there could be some variation from this depending upon design considerations. Right-of-way requirements would typically vary upward from 70 m (228 ft) depending upon cut and fill requirements.

M - Eight Lanes Divided with Raised Median, Curb & Gutter

Also used for controlled access freeways, this cross section may be recommended for freeways going through major urban areas or for routes projected to carry very high volumes of traffic.

N - Five Lanes, Curb & Gutter, Widened Curb Lanes
O - Two Lanes, Shoulder Section
P - Four Lanes Divided with Raised Median, Curb & Gutter, Widened Curb Lanes

If there is sufficient bicycle travel along the thoroughfare to justify a bicycle lane or bikeway, additional right-of-way may be required to contain the bicycle facilities. The North Carolina Bicycle Facilities Planning and Design Guidelines should be consulted for design standards for bicycle facilities.

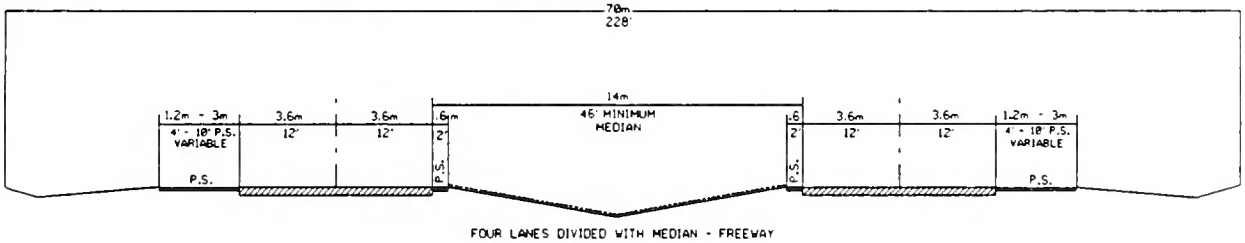
Other General Information

The urban curb & gutter cross sections illustrate the sidewalk adjacent to the curb with a buffer or utility strip between the sidewalk and the minimum right-of-way line. This permits adequate setback for utility poles. If the sidewalk is moved farther away from the street to provide additional separation for pedestrians or for aesthetic reasons, additional right-of-way must be provided to insure adequate setback for utility poles.

The rights-of-way shown for the typical cross sections are the minimum required to contain the street, sidewalks, utilities, and drainage facilities. Additional cut and fill may require either additional right-of-way or construction easements. Obtaining construction easements is becoming the more common practice for urban thoroughfare construction.

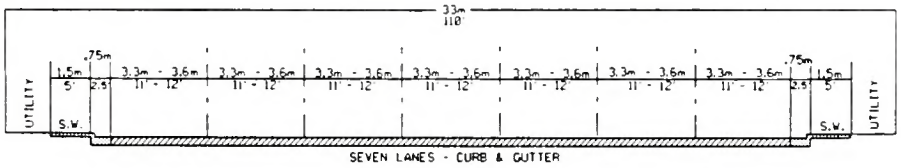
TYPICAL THOROUGHFARE CROSS SECTIONS

A.



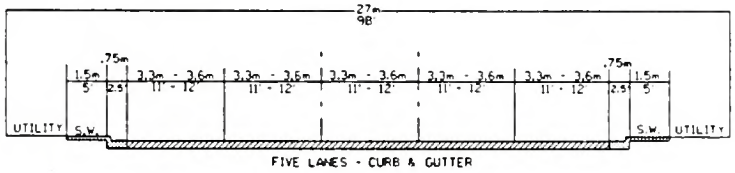
FOUR LANES DIVIDED WITH MEDIAN - FREEWAY

B.



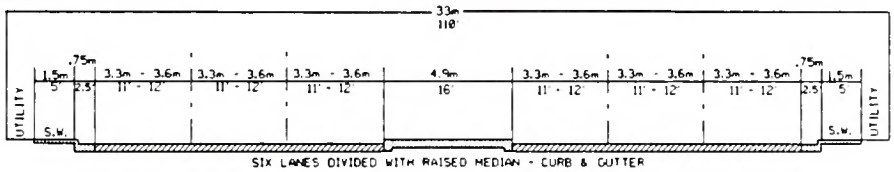
SEVEN LANES - CURB & GUTTER

C.



FIVE LANES - CURB & GUTTER

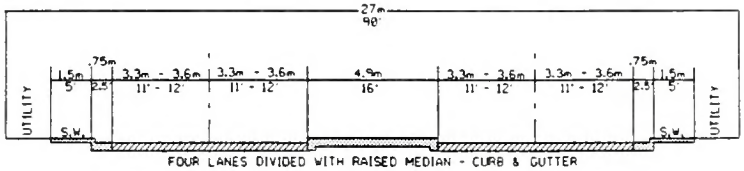
D.



SIX LANES DIVIDED WITH RAISED MEDIAN - CURB & GUTTER

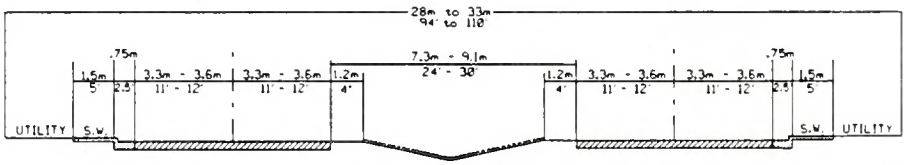
TYPICAL THOROUGHFARE CROSS SECTIONS

E.



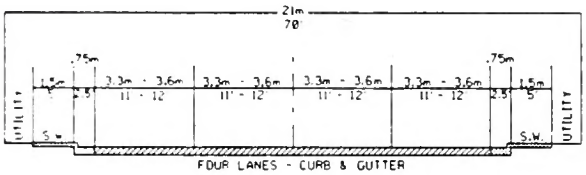
FOUR LANES DIVIDED WITH RAISED MEDIAN - CURB & GUTTER

F.



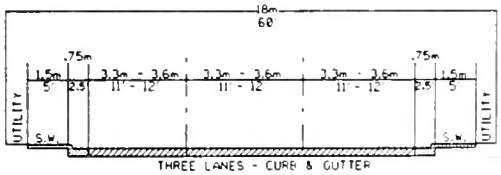
FOUR LANES DIVIDED - BOULEVARD
GRASS MEDIAN

G.



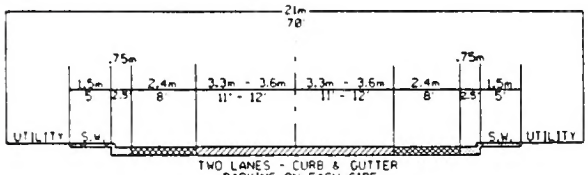
FOUR LANES - CURB & GUTTER

H.



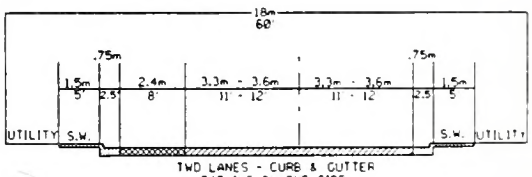
THREE LANES - CURB & GUTTER

I.



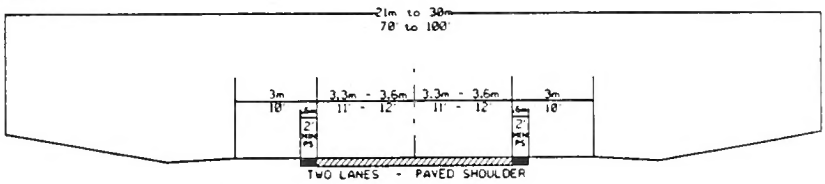
TWO LANES - CURB & GUTTER
PARKING ON EACH SIDE

J.



TWO LANES - CURB & GUTTER
PARKING ON ONE SIDE

K.

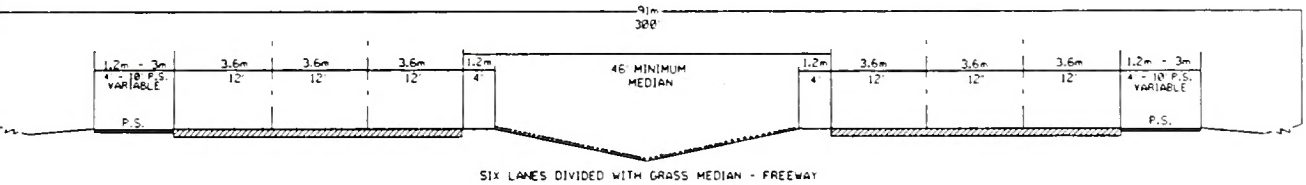


TWO LANES - PAVED SHOULDER

A6

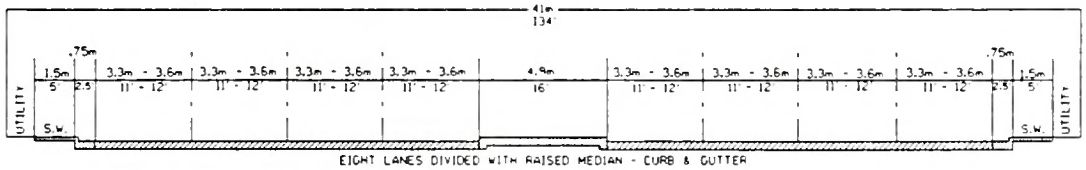
TYPICAL THOROUGHFARE CROSS SECTIONS

L.



SIX LANES DIVIDED WITH GRASS MEDIAN - FREEWAY

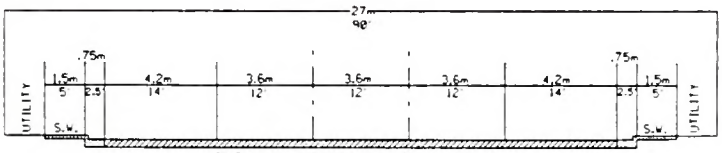
M.



EIGHT LANES DIVIDED WITH RAISED MEDIAN - CURB & GUTTER

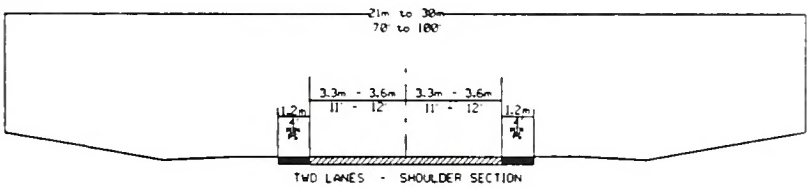
TYPICAL THOROUGHFARE CROSS SECTIONS FOR ACCOMMODATING BICYCLES

N.



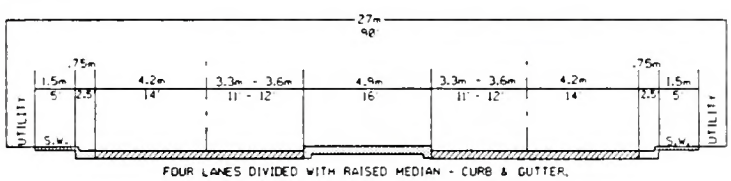
FIVE-LANE ROADWAY WITH CURB & GUTTER,
STANDARD INSIDE LANES & WIDENED CURB LANES

O.



TWO LANES - SHOULDER SECTION

P.



FOUR LANES DIVIDED WITH RAISED MEDIAN - CURB & GUTTER,
STANDARD INSIDE LANES & WIDENED CURB LANES

Table A-1

GRIFTON STREET INVENTORY AND RECOMMENDATIONS	EXISTING DIST (MI)	DIST (km)	CROSS SECTION RDWY FT(m)/LANES	ROW (FT)	ROW (m)	PRACTICAL CAPACITY (VPD)	AVG DAILY TRAFFIC 1995 (VPD)	2010 (VPD)	2020 (VPD)	PROPOSED CROSS SECTION RDWY (Code/LNS)	ROW (FT)	ROW (m)	PRACTICAL CAPACITY (VPD)	ADT 2020 (VPD)
NC 11														
Grifton NPB - SR 1110	0.50	0.81	48 (14.4) / 4LD	260	79	35,000	12,500	25,200	37,800	* / 6LD	ADQ	ADQ	65,000	37,800
SR 1110 - SR 1939	0.25	0.40	48 (14.4) / 4LD	260	79	35,000	11,800	23,800	35,900	* / 6LD	ADQ	ADQ	65,000	35,900
SR 1939 - Lenoir/Pitt Co Line	2.20	3.55	48 (14.4) / 4LD	260	79	35,000	N/A	---	---	* / 6LD	ADQ	ADQ	65,000	---
Lenoir/Pitt Co Line - SR 1091	1.78	2.87	48 (14.4) / 4LD	260	79	35,000	9,700	20,900	32,500	* / 6LD	ADQ	ADQ	65,000	32,500
SR 1091 - 0.22 mi south	0.22	0.35	44 (13.2) / 4LD	260	79	35,000	9,200	21,100	33,100	* / 6LD	ADQ	ADQ	65,000	33,100
0.22 mi S of SR 1091 - SR 1716	0.17	0.27	44 (13.2) / 4LD	120	37	35,000	9,200	21,100	33,100	* / 6LD	ADQ	ADQ	65,000	33,100
SR 1716 - 0.14 mi south	0.14	0.23	44 (13.2) / 4LD	120	37	35,000	N/A	---	---	* / 6LD	ADQ	ADQ	65,000	---
0.14 mi S of 1716 - SR 1757	0.11	0.18	48 (14.4) / 4LD	120	37	35,000	N/A	---	---	* / 6LD	ADQ	ADQ	65,000	---
SR 1757 - SR 1801	0.50	0.81	48 (14.4) / 4LD	120	37	35,000	11,300	25,500	36,000	* / 6LD	ADQ	ADQ	65,000	36,000
SR 1801 - SPB Grifton	0.16	0.26	48 (14.4) / 4LD	120	37	35,000	13,000	27,900	40,100	* / 6LD	ADQ	ADQ	65,000	40,100
										* Modified Cross Section L				
NC 118														
NC 11 - SR 1757	0.36	0.58	24 (7.2) / 2L	60	18	11,000	1,500	2,300	3,100	ADQ	ADQ	ADQ	ADQ	2,700
SR 1757 - SR 1800	0.38	0.61	24 (7.2) / 2L	N/A	N/A	11,000	N/A	---	---	C / 5L	90	27	25,000	---
NC 118, S Highland Blvd														
SR 1800 - Pitt/Lenoir Line	0.10	0.16	20 (6.0) / 2L	N/A	N/A	9,000	N/A	---	---	C / 5L	90	27	25,000	---
Pitt/Lenoir Line - Main Street	0.41	0.66	20 (6.0) / 2L	80	24	9,000	N/A	---	---	C / 5L	90	27	25,000	---
Main St - SR 1939	0.13	0.21	40 (12.0) / 3L	80	24	15,000	5,500	9,200	13,000	C / 5L	90	27	25,000	10,600
NC 118, Queen St														
SR 1939 - Pitt Street	0.30	0.48	46 (14.0) / 2LP	80	24	10,000	5,300	8,900	12,100	G / 4L	ADQ	ADQ	22,000	9,500
Pitt St - SR 1907	0.06	0.10	30 (9.0) / 2LP	80	24	10,000	N/A	---	---	G / 4L	ADQ	ADQ	22,000	---
SR 1907 - ECL Grifton	0.49	0.79	20 (6.0) / 2L	80	24	9,000	3,600	6,100	8,800	G / 4L	ADQ	ADQ	22,000	6,400
ECL Grifton - SR 1910	0.90	1.45	20 (6.0) / 2L	100	30	9,000	2,800	5,200	7,500	G / 4L	ADQ	ADQ	22,000	5,000
SR 1910 - EPB	0.20	0.32	20 (6.0) / 2L	100	30	9,000	2,600	4,900	7,200	K / 2L	ADQ	ADQ	11,000	7,200
NC 118 Southern Bypass														
NC 11 - NC 118	Proposed									K / 2L	100	30	11,000	2,800
Grifton Northern Loop														
NC 118 - SR 1911, Wall St	Proposed									K / 2L	100	30	11,000	1,200
SR 1911 - SR 1907, Church St	Proposed									K / 2L	100	30	11,000	1,200
Utilize Casey Dr	0.30	0.48	20 (6.0) / 2L	N/A	N/A	9,000	N/A	---	---	K / 2L	70	21	11,000	1,500
Casey Dr - SR 1939, N Highland	Proposed									K / 2L	100	30	11,000	1,500

Table A-1

GRIFTON STREET INVENTORY AND RECOMMENDATIONS	EXISTING DIST (MI)	DIST (km)	CROSS SECTION RDWY (FT/LANES)	ROW (FT)	ROW (m)	PRACTICAL CAPACITY (VPD)	AVG DAILY TRAFFIC 1995 (VPD)	2010 (VPD)	2020 (VPD)	PROPOSED CROSS SECTION RDWY (Code/LNS)	ROW (FT)	ROW (m)	PRACTICAL CAPACITY (VPD)	ADT 2020 (VPD)
Secondary Roads In Pitt County														
SR 1102, Sam McLawhorn Rd														
SR 1939 (north) - SR 1103	0.33	0.53	20 (6.0) / 2L	N/A	N/A	9,000	50	250	300	ADQ	ADQ	ADQ	ADQ	300
SR 1103 - SR 1939 (south)	0.30	0.48	20 (6.0) / 2L	N/A	N/A	9,000	230	400	500	ADQ	ADQ	ADQ	ADQ	500
SR 1103, Blount Hall Rd														
SR 1102 - End	0.38	0.61	20 (6.0) / 2L	60	18	9,000	240	---	---	ADQ	ADQ	ADQ	ADQ	---
SR 1104, W. W. Gaskins Rd														
SR 1939 - NC 11	0.20	0.32	18 (5.4) / UN	N/A	N/A	2,000	N/A	---	---	PAVE	70	21	10,000	---
SR 1110, Hanrahan Rd														
NC 11 - SR 1907	2.30	3.71	20 (6.0) / 2L	N/A	N/A	9,000	2,700	4,500	6,400	K / 2L	70	21	11,000	6,000
SR 1907, Church St														
NC 118 - SR 1909, Dawson St	0.15	0.24	36 (10.8) / 2L	60	18	12,000	2,400	3,800	4,600	ADQ	ADQ	ADQ	ADQ	3,900
SR 1909 - St David St	0.34	0.55	36 (10.8) / 2L	N/A	N/A	12,000	2,900	4,300	5,100	ADQ	ADQ	ADQ	ADQ	4,700
St David St - SR 1110	2.29	3.69	20 (6.0) / 2L	N/A	N/A	9,000	N/A	2,200	2,900	K / 2L	70	21	11,000	2,500
SR 1909, Dawson Rd														
NC 118 - Wall St	0.28	0.45	18 (5.4) / 2L	N/A	N/A	8,000	250	700	1,400	K / 2L	70	21	11,000	1,200
Wall St - SR 1907	0.70	1.13	18 (5.4) / 2L	N/A	N/A	8,000	1,200	1,600	2,000	K / 2L	70	21	11,000	1,800
SR 1910, South St, Shore Dr, Wiley Gaskins Rd														
NC 118 - Shore Dr	0.23	0.37	40 (12.0) / 2L	N/A	N/A	12,000	900	1,200	1,500	ADQ	ADQ	ADQ	ADQ	1,500
Shore Dr - SCL Grifton	0.44	0.71	20 (6.0) / 2L	N/A	N/A	9,000	N/A	---	---	ADQ	ADQ	ADQ	ADQ	---
SCL Grifton - SR 1914	1.12	1.81	20 (6.0) / 2L	60	18	9,000	80	---	---	ADQ	ADQ	ADQ	ADQ	---
SR 1914 - NC 118	0.80	1.29	20 (6.0) / 2L	70	21	9,000	300	600	800	ADQ	ADQ	ADQ	ADQ	800
SR 1911, Wall St														
SR 1909 - ECL Grifton	0.64	1.03	20 (6.0) / 2L	N/A	N/A	9,000	N/A	---	---	ADQ	ADQ	ADQ	ADQ	---
ECL Grifton - EPB	1.00	1.61	18 (5.4) / 2L	N/A	N/A	8,000	130	300	400	PAVE	70	21	11,000	400

Table A-1

GRIFTON STREET INVENTORY AND RECOMMENDATIONS	EXISTING DIST (MI)	DIST (km)	CROSS SECTION RDWY (FT/LANES)	ROW (FT)	ROW (m)	PRACTICAL CAPACITY (VPD)	AVG DAILY TRAFFIC 1995 (VPD)	2010 (VPD)	2020 (VPD)	PROPOSED CROSS SECTION RDWY (Code/LNS)	ROW (FT)	ROW (m)	PRACTICAL CAPACITY (VPD)	ADT 2020 (VPD)
SR 1914, Jolly Ole Field Rd														
SR 1910 - SPB	0.20	0.32	18 (5.4) / 2L	N/A	N/A	8,000	N/A	---	---	ADQ	ADQ	ADQ	ADQ	---
SR 1939, N Highland Blvd														
NC 118 - North of McCrae St	0.12	0.19	40 (12.0) / 3L	60	18	15,000	N/A	5,600	7,700	ADQ	ADQ	ADQ	ADQ	7,000
North of McCrae - NCL Grifton	0.60	0.97	28 (8.4) / 2L	60	18	12,000	N/A	5,500	7,400	ADQ	ADQ	ADQ	ADQ	6,700
NCL Grifton - NC 11	1.25	2.02	20 (6.0) / 2L	100	30	9,000	3,400	5,300	7,100	K / 2L	ADQ	ADQ	11,000	7,300
SR 1940, Dudley Rd														
SR 1939 - SR 1110	0.50	0.81	20 (6.0) / 2L	100	30	9,000	N/A	---	---	ADQ	ADQ	ADQ	ADQ	---
Charles St and Extension														
Pitt St - SR 1907	0.09	0.15	18 (5.4) / 2L	N/A	N/A	9,000	N/A	---	---	K / 2L	70	21	11,000	---
SR 1907 - 0.06 mi E of Wall St	0.34	0.55	18 (5.4) / 2L	N/A	N/A	9,000	N/A	---	---	K / 2L	70	21	11,000	---
Dead End - Dawson St	********** Proposed **********									K / 2L	70	21	11,000	800
DuPont Ave and Extension														
Queen St - McCrae St	0.08	0.13	24 (7.2) / 2L	N/A	N/A	11,000	N/A	---	---	ADQ	ADQ	ADQ	ADQ	---
McCrae St - Quinerly St	0.20	0.32	30 (9.0) / 2L	N/A	N/A	12,000	N/A	---	---	ADQ	ADQ	ADQ	ADQ	---
Quinerly St - Northern Loop	********** Proposed **********									K / 2L	100	30	11,000	500
McCrae Street														
South St - SR 1939, N Highland	0.51	0.82	20 (6.0) / 2L	N/A	N/A	9,000	N/A	---	---	ADQ	ADQ	ADQ	ADQ	---
Secondary Roads In Lenoir County														
SR 1091														
WPB - NC 11	0.66	1.06	18 (5.4) / 2L	N/A	N/A	8,000	1,700	2,600	3,400	K / 2L	100	30	11,000	3,400
NC 11 - WCL Grifton	0.29	0.47	22 (6.6) / 2L	60	18	10,000	1,500	2,300	3,100	K / 2L	100	30	11,000	3,100
WCL Grifton - NC 118	0.24	0.39	23 (6.9) / 2L	N/A	N/A	10,000	1,500	2,300	3,100	K / 2L	100	30	11,000	3,100
SR 1195, Harvey Rd														
SR 1091 - SR 1716	0.37	0.60	18 (5.4) / 2L	N/A	N/A	8,000	N/A	---	---	ADQ	ADQ	ADQ	ADQ	---

Table A-1

GRIFTON *STREET INVENTORY AND RECOMMENDATIONS*	EXISTING DIST (MI)	DIST (km)	CROSS SECTION RDWY (FT/LANES)	ROW (FT)	ROW (m)	PRACTICAL CAPACITY (VPD)	AVG DAILY TRAFFIC 1995 (VPD)	2010 (VPD)	2020 (VPD)	PROPOSED CROSS SECTION RDWY (Code/LNS)	ROW (FT)	ROW (m)	PRACTICAL CAPACITY (VPD)	ADT 2020 (VPD)
SR 1709, Hugh Rd														
NC 11 - WPB	0.38	0.61	18 (5.4) / 2L	N/A	N/A	8,000	350	600	800	ADQ	ADQ	ADQ	ADQ	800
SR 1714, Creek Rd														
NC 118 - WPB	0.76	1.23	22 (6.6) / UN	N/A	N/A	2,000	N/A	---	---	PAVE	70	21	10,000	---
SR 1715, Smith Rd														
SR 1709 - SR 1714	0.50	0.81	18 (5.4) / 2L	N/A	N/A	8,000	N/A	---	---	ADQ	ADQ	ADQ	ADQ	---
SR 1716, Rouse Rd														
SR 1757 - NC 11	0.30	0.48	20 (6.0) / UN	60	18	2,000	N/A	---	---	PAVE	70	21	10,000	---
NC 11 - SR 1709	0.30	0.48	20 (6.0) / 2L	60	18	9,000	N/A	---	---	ADQ	ADQ	ADQ	ADQ	---
SR 1717, Pine Villa St														
NC 11 - SR 1718	0.25	0.40	22 (6.6) / UN	60	18	2,000	N/A	---	---	PAVE	ADQ	ADQ	10,000	---
SR 1718 - END	0.30	0.48	20 (6.0) / 2L	60	18	9,000	N/A	250	400	ADQ	ADQ	ADQ	ADQ	400
SR 1718, Brooks Rd														
NC 11 - WPB	0.38	0.61	20 (6.0) / 2L	60	18	9,000	120	300	400	ADQ	ADQ	ADQ	ADQ	400
SR 1756														
SR 1091 - SR 1716	0.40	0.65	20 (6.0) / 2L	60	18	9,000	N/A	250	350	ADQ	ADQ	ADQ	ADQ	350
SR 1757														
NC 11 - NC 118	0.57	0.92	24 (7.2) / 2L	100	30	11,000	4,000	6,500	8,900	C / 5L	ADQ	ADQ	25,000	8,600
SR 1800, Contentnea Dr, Lenoir St, and Maple Ct														
NC 118 - SCL Grifton	0.63	1.02	18 (5.4) / 2L	N/A	N/A	8,000	1,000	1,400	1,700	K / 2L	70	21	11,000	1,700
SCL Grifton - SR 1801	1.14	1.84	18 (5.4) / 2L	N/A	N/A	8,000	N/A	---	---	K / 2L	70	21	11,000	---
SR 1801, Saw Mill Rd														
NC 11 - SR 1802	0.72	1.16	18 (5.4) / 2L	N/A	N/A	8,000	1,300	1,750	2,200	K / 2L	70	21	11,000	2,200
SR 1802 - SR 1800	0.78	1.26	18 (5.4) / 2L	N/A	N/A	8,000	600	1,400	1,800	K / 2L	70	21	11,000	1,800

Table A-1

GRIFTON STREET INVENTORY AND RECOMMENDATIONS	EXISTING DIST (MI)	DIST (km)	CROSS SECTION RDWY (FT/LANES)	ROW (FT)	ROW (m)	PRACTICAL CAPACITY (VPD)	AVG DAILY TRAFFIC 1995 (VPD)	2010 (VPD)	2020 (VPD)	PROPOSED CROSS SECTION RDWY (Code/LNS)	ROW (FT)	ROW (m)	PRACTICAL CAPACITY (VPD)	ADT 2020 (VPD)
SR 1802, Braxton Rd														
NC 11 - SR 1801	1.80	2.90	18 (5.4) / 2L	N/A	N/A	8,000	800	1,200	1,600	K / 2L	70	21	11,000	1,600

APPENDIX B

Appendix B
Thoroughfare Planning Principles

Objectives

Typically, the urban street system occupies 25 to 30 percent of the total developed land in an urban area. Since the system is permanent and expensive to build and maintain, much care and foresight are needed in its development. Thoroughfare planning is the process that public officials use to assure the development of the most appropriate street system that will meet existing and future travel desires within the urban area.

The primary aim of a thoroughfare plan is to guide the development of the urban street system in a manner consistent with the changing traffic patterns. A thoroughfare plan will enable street improvements to be made as traffic demands increase, and it helps eliminate unnecessary improvements, so needless expense can be averted. By developing the urban street system to keep pace with increasing traffic demands, a maximum utilization of the system can be attained, requiring a minimum amount of land for street purposes. In addition to providing for traffic needs, the thoroughfare plan should embody those details of good urban planning necessary to present a pleasing and efficient urban community. The location of present and future population, commercial, and industrial development affects major street and highway locations. Conversely, the location of major streets and highways within the urban area will influence the urban development pattern.

Other objectives of a thoroughfare plan include:

1. providing for the orderly development of an adequate major street system as land development occurs;
2. reducing travel and transportation costs;
3. reducing the cost of major street improvements to the public through the coordination of the street system with private action;
4. enabling private interests to plan their actions, improvements, and development with full knowledge of public intent;
5. minimizing disruption and displacement of people and businesses through long range advance planning for major street improvements;
6. reducing environmental impacts, such as air pollution, resulting from transportation; and
7. increasing travel safety.

Thoroughfare planning objectives are achieved through both improving the operational efficiency of thoroughfares and improving the system's efficiency through system coordination and layout.

Operational Efficiency

A street's operational efficiency is improved by increasing the capability of the street to carry more vehicular traffic and people. In terms of vehicular traffic, a street's capacity is defined by the maximum number of vehicles which can pass a given point on a roadway during a given time period under prevailing roadway and traffic conditions. Capacity is affected by the physical features of the roadway, nature of traffic, and weather.

Physical ways to improve vehicular capacity include street widening, intersection improvements, improving vertical and horizontal alignment, and eliminating roadside obstacles. For example, widening of a street from two to four lanes more than doubles the capacity of the street by providing additional maneuverability for traffic. This reduces the impedances to traffic flow caused by slow moving or turning vehicles and the adverse effects of horizontal and vertical alignments.

Operational ways to improve street capacity include:

1. *Control of access* -- A roadway with complete access control can often carry three times the traffic handled by a non-controlled-access street with identical lane width and number.
2. *Parking removal* -- Parking removal increases capacity by providing additional street width for traffic flow and reducing friction to flow caused by parking vehicles.
3. *One-way operation* -- The capacity of a street can sometimes be increased 20-50%, depending upon turning movements and overall street width, by initiating one-way traffic operations. One-way streets can also improve traffic flow by decreasing potential traffic conflicts and simplifying traffic signal coordination.
4. *Reversible lanes* -- Reversible traffic lanes may be used to increase street capacity in situations where heavy directional flows occur during peak periods.
5. *Signal phasing and coordination* -- Uncoordinated signals and poor signal phasing restrict traffic flow by creating excessive stop-and-go operation.
6. *Intelligent Transportation System (ITS)* -- This involves applying advanced concepts and technology in the area of communications, navigation, and information systems to provide solutions to traffic congestion and at the same time improve (highway) safety and reduce environmental effects. It covers passengers, freight, and public transit vehicles and fleets. The ITS Program is structured according to five major systems areas. They are:
    - Advanced Traffic Management Systems - Provides real- time adjustment of traffic control systems and real- time means for transportation operators to effectively monitor traffic conditions and communicate to devices, quickly adjust traffic operations, and promptly respond to incidents.
    - Advanced Traveler Information Systems - Provides continuous advice regarding traffic conditions, alternate routes, and warnings regarding road safety.

- Commercial Vehicle Operations - Improves operations efficiency and productivity of trucks, buses, and other fleets of vehicles and improves the efficiency of necessary regulatory activities.
- Advanced Vehicle Control Systems - Vehicle and/or roadway based electromechanical and communication devices that enhance the control of vehicles by facilitating and augmenting driver performance and ultimately relieving the driver of most tasks on designated instrumented roadways.
- Advanced Public Transportation Systems - Provides mass transport users and operators (e.g. buses, vanpools, high-occupancy vehicle lanes, carpools, taxicabs) with up-to-date information on status, schedules, and availability of public transit systems including automatic vehicle location and monitoring systems to improve fleet management as well as electronic free media.
- Advanced Rural Transportation Systems - Applies ITS technologies (including route guidance, two-way communications, automatic vehicle location, automatic emergency signaling, incident detection, and roadway edge detection) to rural needs.

7. *High-Occupancy Vehicle Lanes (HOV Lanes)* -- This involves designating existing traffic lanes for exclusive use by high-occupancy vehicles like carpools, vanpools, and buses. These can be altered according to demand to increase capacity. For example, HOV lanes can be designated HOV only during peak hours and/or can be reversible between the morning and afternoon peak hours to reflect the shift in directional flow of traffic.

Altering travel demand is a third way to improve the efficiency of existing streets. Travel demand can be reduced or altered in the following ways.

1. Encourage people to form carpools and vanpools for journeys to work and other trip purposes. This reduces the number of vehicles on the roadway and raises the "people-carrying" capability of the street system.
2. Encourage the use of transit and bicycle modes.
3. Encourage industries, businesses, and institutions to stagger work hours or establish variable work hours for employees. This will spread peak travel over a longer time period and thus reduce peak hour demand.
4. Plan and encourage land use development or redevelopment in a more travel efficient manner.

System Efficiency

Another means for altering travel demand is the development of a more efficient system of streets that will better serve travel desires. A more efficient system can reduce travel distances, time, and cost to the user. Improvements in system efficiency can be achieved through the concept of functional classification of streets and development of a coordinated major street system.

Functional Classification

Streets perform two primary functions -- traffic service and land service. When combined, these services are basically incompatible. The conflict is not serious if both traffic and land service demands are low. However, when traffic volumes are high, conflicts created by uncontrolled and intensely used abutting property leads to intolerable traffic flow friction and congestion.

The thoroughfare plan provides a functional system of streets that permits travel from origins to destinations with directness, ease, and safety. Different streets in the system perform different functions, thus minimizing the traffic and land service conflict. Streets are categorized by function as major thoroughfares, minor thoroughfares, or local access streets. These categories are described below and shown in Figure B-1.

- *Local Access Streets* provide access to abutting property. They are not intended to carry heavy volumes of traffic and should be located such that only traffic with origins and destinations on these streets would be served. Local streets may be further classified as either residential, commercial, and/or industrial depending upon the type of land use they serve.

- *Minor Thoroughfare* are more important streets on the city system. They collect traffic from local access streets and carry it to the major thoroughfares. They may in some instances supplement the major thoroughfare system by facilitating minor through-traffic movements. A third function that may be performed is that of providing access to abutting property. They should be designed to serve limited areas so that their development as major thoroughfares will be prevented.

- *Major Thoroughfares* are the primary traffic arteries of the city. Their function is to move intra-city and inter-city traffic. The streets which comprise the major thoroughfare system may also serve abutting property; however, their principle function is to carry traffic. They should not be bordered by uncontrolled strip development because such development significantly lowers the capacity of the thoroughfare to carry traffic. In addition, each driveway is a danger and an impediment to traffic flow. Major thoroughfares may range from two-lane streets carrying minor traffic volumes to major expressways with four or more traffic lanes. Parking normally should not be permitted on major thoroughfares.

Idealized Major Thoroughfare System

A coordinated system of major thoroughfares forms the basic framework of the urban street system. A major thoroughfare system which is most adaptable to desire lines of travel within an urban area is the radial-loop system. It permits movement between various areas of the city within maximum directness. This system consists of several functional elements -- radial streets, cross-town streets, loop system streets, and bypasses. These functional elements are shown in Figure B-1 and described on the following pages.

- *Radial streets* provide for traffic movement between points located on the outskirts of the city and the central area. This is a major traffic movement in most cities, and the economic strength of the central business district depends upon the adequacy of this type of thoroughfare.

- *Cross-town streets* are designed to prevent congestion in the central business district. If all radial streets crossed in the central area, an intolerable congestion problem would result. To avoid this problem, it is important to have a system of cross-town streets which form a loop around the central business district. This system allows traffic moving from origins on one side of the central area to destinations on the other side to follow the area's border. It also allows central area traffic to circle and then enter the area near a given destination. The effect of a good cross-town system is to free the central area of cross-town traffic, thus permitting the central area to function more adequately in its role as a business or pedestrian shopping area.

- *Loop system streets* move traffic between suburban areas of the city. Although a loop may completely encircle the city, a typical trip may be from an origin near a radial thoroughfare to a destination near another radial thoroughfare. Loop streets do not necessarily carry heavy volumes of traffic, but they function to help relieve central areas. There may be one or more loops, depending on the size of the urban area. They are generally spaced one-half mile to one mile apart, depending on the intensity of land use.

- *A bypass* is designed to carry traffic through or around the urban area, thus providing relief to the city street system by removing traffic which has no desire to be in the city. Bypasses are usually designed to through-highway standards, with control of access. Occasionally, a bypass with low traffic volumes can be designed to function as a portion of an urban loop. The general effect of bypasses is to expedite the movement of through-traffic and to improve traffic conditions within the city. By freeing the local streets for use by shopping and home-to-work traffic, bypasses tend to increase the economic vitality of the local area.

Application of Thoroughfare Planning Principles

The concepts presented in the discussion of operational efficiency, functional classification, and idealized major thoroughfare system are the conceptual tools available to the transportation planner in developing a thoroughfare plan. In actual practice, a thoroughfare plan is developed for established urban areas and is constrained by the existing land use and street patterns, existing public attitudes and goals, and current expectations of future land use. Compromises must be made because of these constraints and the many other factors that affect major street locations.

APPENDIX C

Appendix C
Benefits Analysis

Reduced road user costs should result from any roadway improvement, from a simple widening to the construction of a new roadway to relieve congested or unsafe conditions. Comparisons of the existing and the proposed facilities have been made in terms of vehicle operating costs, travel time costs, and accident costs. These user benefits are computed as total dollar savings over the design period using data such as project length, base year and design year traffic volumes, traffic speed, type of facility, and volume/capacity ratio.

The impact of a project on economic development potential is shown as the probability that it will stimulate the economic development of an area by providing access to developable land and reducing transportation costs. It is a subjective estimate based on the knowledge of the proposed project, local development characteristics, and land development potential. The probability is rated on a scale from 0 (representing no development potential) to 1.00 (representing excellent development potential).

The environmental impact analysis considers the effect of a project on the physical, social/cultural, and economic environment. Below is a list of the items that are considered when evaluating the impacts on the environment.

Table C-1

Environmental Considerations		
Physical Environment	**Social and Cultural Environment**	**Economic Environment**
Air quality	Housing	Businesses
Water Resources	Neighborhoods	Employment
Soils and Geology	Noise	Economic Development
Wildlife	Educational Facilities	Public Utilities
Vegetation	Churches	Transportation Costs
	Parks/Recreational Facilities	Capital Costs
	Public Health and Safety	Operation/Maintenance Costs
	National Defense	
	Aesthetics	

The environmental impact analysis also uses a probability rating from 0 to 1.00. A negative value is assigned to the probability to indicate a negative impact. The summation of both positive and negative impact probabilities with respect to these factors provides a measure of the relative environmental impacts of a project. Table C-2 shows the probability scale used in the analysis. This table can be used as a guideline for interpreting the "Economic Development" and "Environmental Impact" values given in Table C-1.

Table C-2

Impact	Probability
High	1.00
Significant	0.75
Moderate	0.50
Slight	0.25
None	0.00

Offsetting the benefits that would be derived from any project is the cost of its construction. A new facility, despite its high projected benefits, might prove to be unjustified due to the excessive costs involved in construction. Table C-3 provides a breakdown of total project costs into construction costs and right-of-way costs for the major project proposals on the Grifton Thoroughfare Plan. It also lists the estimated benefits, including savings in vehicle operating costs, travel time costs, and accident reductions, that would be derived from each project over the next 25 years.

As shown, several projects, if built today, would not generate enough benefits to cover their costs and, thus, would not be prudent expenditures of public money at the present time. However, as development continues in the Grifton area and traffic volumes increase on these roads, there will be a greater need for these projects and the benefits realized by constructing them will increase. These projects should be built only when the estimated benefits outweigh the anticipated costs. Based on this analysis, the projects below were placed into three time periods for construction, as shown in Table 1 on page 8 of this report.

Table C-3

Benefits Evaluation of Selected Thoroughfare Plan Projects

Project	Total Length (Miles) [km]	25-year Accrued Benefits ($ Millions)	Project Cost ($ Millions)	Econ. Develop-ment Potential	Enviro. Impact Prob.
NC 11 *Widen from 4 to 6 lanes*	6.0 [9.7]	$ 9.4	C $ 22.3 R $ 0.0	+ .25	+ .25 - .50
NC 118/Queen Street *Widen from 2 to 4 lanes*	1.8 [2.8]	$ 3.1	C $ 3.3 R $ 0.3	+ .50	+ .30 - .20
NC 118/South Highland Blvd *5 lanes from Queen St to SR 1800*	0.6 [1.0]	$ 2.4	C $ 3.6 R $ 0.0	+ .60	+ .25 - .50
Northern Loop *New 2-lane facility*	1.8 [2.9]	$ 10.9	C $ 3.0 R $ 0.4	+ .50	+ .30 - .40
NC 118 Southern Bypass *New 2-lane facility*	3.2 [5.1]	$ 8.7	C $ 8.6 R $ 0.6	+ .40	+ .30 - .60
NC 118/SR 1757/S Highland *5 lanes from SR 1800 to NC 11*	1.0 [1.5]	$ 1.1	C $ 3.0 R $ 0.0	+ .50	+ .20 - .20

APPENDIX D

Appendix D
Recommended Definitions and Design Standards for Subdivision Ordinances

Definitions

Streets and Roads

Rural Roads

1. *Principal Arterial* - A rural link in a highway system serving travel, and having characteristics indicative of substantial statewide or interstate travel and existing solely to serve traffic. This network would consist of Interstate routes and other routes designated as principal arterials.

2. *Minor Arterial* - A rural roadway joining cities and larger towns and providing intra-state and inter-county service at relatively high overall travel speeds with minimum interference to through movement.

3. *Major Collector* - A road which serves major intra-county travel corridors and traffic generators and provides access to the Major Collector system.

4. *Minor Collector* - A road which provides service to small local communities and traffic generators and provides access to the Major Collector system.

5. *Local Road* - A road which serves primarily to provide access to adjacent land, over relatively short distances.

Urban Streets

1. *Major Thoroughfares* - Major thoroughfares consist of Inter-state, other freeway, expressway, or parkway roads, and major streets that provide for the expeditious movement of high volumes of traffic within and through urban areas.

2. *Minor Thoroughfares* - Minor thoroughfares perform the function of collecting traffic from local access streets and carrying it to the major thoroughfare system. Minor thoroughfares may be used to supplement the major thoroughfare system by facilitating minor through traffic movements and may also serve abutting property.

3. *Local Street* - A local street is any street not on a higher order urban system and serves primarily to provide direct access to abutting land.

Specific Type Rural or Urban Streets

1. *Freeway, expressway, or parkway* - Divided multi-lane roadways designed to carry large volumes of traffic at high speeds. A *freeway* provides for continuous flow of vehicles with no direct access to abutting property and with access to selected

crossroads only by way of interchanges. An *expressway* is a facility with full or partial control of access and generally with grade separations at major intersections. A *parkway* is for non-commercial traffic, with full or partial control of access.

2. *Residential Collector Street* - A local street which serves as a connector street between local residential streets and the thoroughfare system. Residential collector streets typically collect traffic from 100 to 400 dwelling units.

3. *Local Residential Street* - Cul-de-sacs, loop streets less than 750 meters in length, or streets less than 1.5 kilometers in length that do not connect thoroughfares, or serve major traffic generators, and do not collect traffic from more than 100 dwelling units.

4. *Cul-de-sac* - A short street having only one end open to traffic and the other end being permanently terminated and a vehicular turn around provided.

5. *Frontage Road* - A road that is parallel to a partial or full access controlled facility and provides access to adjacent land.

6. *Alley* - A strip of land, owned publicly or privately, set aside primarily for vehicular service access to the back side of properties otherwise abutting on a street.

Property

Building Setback Line

A line parallel to the street in front of which no structure shall be erected.

Easement

A grant by the property owner for use by the public, a corporation, or person(s), of a strip of land for a specific purpose.

Lot

A portion of a subdivision, or any other parcel of land, which is intended as a unit for transfer of ownership or for development or both. (Also includes "plat" and "parcel").

Subdivision

Subdivider

Any person, firm, corporation, or official agent thereof, who subdivides or develops any land deemed to be a subdivision.

Subdivision

All divisions of a tract or parcel of land into two or more lots, building sites, or other divisions for the purpose, immediate or future, of sale or building development and all divisions of land involving the dedication of a new street or change in existing streets. The following shall not be included within this definition nor subject to these regulations:

- The combination or re-combination of portions of previously platted lots where the total number of lots is not increased and the resultant lots are equal to or exceed the standards contained herein
- the division of land into parcels greater than four hectares where no street right-of-way dedication is involved
- the public acquisition, by purchase, of strips of land for the widening or the opening of streets
- the division of a tract in single ownership whose entire area is no greater than 0.8 hectares into not more than three lots, where no street right-of-way dedication is involved and where the resultant lots are equal to or exceed the standards contained herein.

Dedication
A gift, by the owner, of his property to another party without any compensation being given for the transfer. The dedication is made by written instrument and completed with an acceptance.

Reservation
Reservation of land does not involve any transfer of property rights. It constitutes an obligation to keep property free from development for a stated period of time.

Design Standards

Streets and Roads
The design of all roads within the Planning Area shall be in accordance with the accepted policies of the North Carolina Department of Transportation, Division of Highways, as taken or modified from the American Association of State Highway Officials (AASHTO) manuals.

The provision of street rights-of-way shall conform and meet the recommendations of the Thoroughfare Plan, as adopted. The proposed street layout shall be coordinated with the existing street system of the surrounding area. Normally, the proposed streets should be the extension of existing streets if possible.

Right-of-Way Widths
Right-of-way (ROW) widths shall not be less than the following and shall apply except in those cases where ROW requirements have been specifically set out in the Thoroughfare Plan.

The subdivider will only be required to dedicate a maximum of 30 meters of ROW. In cases where over 30 meters of ROW is desired, the subdivider will be required only to reserve the amount in excess of 30 meters. In all cases in which ROW is sought for a fully controlled access facility, the subdivider will only be required to make a reservation.

It is strongly recommended that subdivisions provide access to properties from internal streets, and that direct property access to major thoroughfares, principal and minor arterials, and major collectors be avoided. Direct property access to minor thoroughfares is also undesirable.

A partial width ROW, not less than eighteen meters in width, may be dedicated when adjoining undeveloped property that is owned or controlled by the subdivider; provided that the width of a partial dedication be such as to permit the installation of such facilities as may be necessary to serve abutting lots. When the said adjoining property is subdivided, the remainder of the full required ROW shall be dedicated.

Table D-1

Minimum Right-of-Way Requirements		
Area Classification	**Functional Classification**	**Minimum ROW**
RURAL	Principal Arterial	Freeways: 105 m Other: 60 m
	Minor Arterial	30 m
	Major Collector	30 m
	Minor Collector	24 m
	Local Road	18[1] m
URBAN	Major Thoroughfare	27 m
	Minor Thoroughfare	21 m
	Local Street	18[1] m
	Cul-de-Sac	variable[2]

[1] The desirable minimum right-of-way (ROW) is 18 m. If curb and gutter is provided, 15 m is adequate on local residential streets.

[2] The ROW dimension will depend on the radius used for vehicular turn around. Distance from edge of pavement of turn around to ROW should not be less than distance from edge of pavement to ROW on street approaching turn around.

Street Widths

Widths for street and road classifications other than local shall be as recommended by the Thoroughfare Plan. Width of local roads and streets shall be as follows:

1. *Local Residential*
   - Curb & Gutter section: 7.8 meters, face to face of curb
   - Shoulder section: 6.0 meters to edge of pavement, 1.2 meters for shoulders

2. *Residential Collector*
   - Curb & Gutter section: 10.2 meters, face to face of curb
   - Shoulder section: 6.0 meters to edge of pavement, 1.8 meters for shoulders

Geometric Characteristics

The standards outlined below shall apply to all subdivision streets proposed for addition to the State Highway System or Municipal Street System. In cases where a subdivision is

sought adjacent to a proposed thoroughfare corridor, the requirements of dedication and reservation discussed under *Right-of-Way* shall apply.

1. *Design Speed* - The design speed for a roadway should be a minimum of 10 km/h (5 mph) greater than the posted speed limit. The design speeds for subdivision type streets are shown in Table D-2.

2. *Minimum Sight Distance* - In the interest of public safety, no less than the minimum sight distance applicable shall be provided. Vertical curves that connect each change in grade shall be provide and calculated using the parameters set forth in Table D-3.

3. *Superelevation* - Table D-4 shows the minimum radius and the related maximum superelevation for design speeds. The maximum rate of roadway superelevation (e) for rural roads with no curb and gutter is 0.08. The maximum rate of superelevation for urban streets with curb and gutter is 0.06, with 0.04 being desirable.

4. *Maximum and Minimum Grades*
   - the maximum grades in percent are shown in Table D-5
   - minimum grade should not be less then 0.5%
   - grades for 30 meters each way from intersections (measured from edge of pavement) should not exceed 5%

Table D-2

Design Speeds (in km/h)			
Facility Type	**Desirable**	**Minimum**	
		Level	**Rolling**
RURAL			
Minor Collector Roads	100	80	60
Local Roads [1]	80	80	60
URBAN			
Major Thoroughfares [2]	100	60	60
Minor Thoroughfares	100	50	50
Local Streets	50	50	30

[1] Local Roads include Residential Collectors and Local Residential

[2] Major Thoroughfares other than Freeways or Expressways

Intersections

1. Streets shall be laid out so as to interest as nearly as possible at right angles, and no street should intersect any other street at an angle less than sixty-five (65) degrees.

2. Property lines at intersections should be set so that the distance from the edge of pavement, of the street turnout, to the property line will be at least as great as the distance from the edge of pavement to the property line along the intersecting streets. This property line can be established as a radius or as a sight triangle. Greater offsets

from the edge of pavement to the property lines will be required, if necessary, to provide sight distance for the stopped vehicle on the side street.

3. Off-set intersections are to be avoided. Intersections which cannot be aligned should be separated by a minimum length of 60 meters between survey centerlines.

Cul-de-sacs

Cul-de-sacs shall not be more than one hundred and fifty (150) meters in length. The distance from the edge of pavement on the vehicular turn around to the right-of-way line should not be less than the distance from the edge of pavement to right-of-way line on the street approaching the turn around. Cul-de-sacs should not be used to avoid connection with an existing street or to avoid the extension of an important street.

Table D-3

Sight Distance					
Design Speed (km/h)	**Stopping Sight Distance (m)**		**Minimum K[1] Values (m)**		**Passing Sight Distance (m) for 2-lanes**
	Desirable	Minimum	Crest Curve	Sag Curve	
30	30	29.6	3	4	*
50	70	57.4	9	11	*
60	90	74.3	14	15	*
90	170	131.2	43	30	*
100	210	157.0	62	37	*

Note: General practice calls for vertical curves to be multiples of 10 meters. Calculated lengths shall be rounded up in each case.

[1] K is a coefficient by which the algebraic difference in grade may be multiplied to determine the length of the vertical curve which will provide the desired sight distance. Sight distance provided for stopped vehicles at intersections should be in accordance with "A Policy on Geometric Design of Highways and Streets, 1990."

* Minimum passing distance for 2-lanes is currently under revision. (Reference NCDOT Roadway Metric Design Manual page 1-12 T-1)

Table D-4

Superelevation Table			
Design Speed (km/h)	**Minimum Radius of Maximum e[1]**		
	e = 0.04	**e = 0.06**	**e = 0.08**
50	100	90	80
65	175	160	145
80	280	250	230
100	490	435	395

[1] e = Rate of roadway superelevation, meter per meter

Note: Reference NCDOT Roadway Design Manual, page 1-12 T-6 through T-8

Table D-5

Maximum Vertical Grade				
Facility Type	**Design Speed (km/h)**	**Minimum Grade in Percent**		
		Flat	Rolling	Mountainous
RURAL				
Minor Collector Roads *	30	7	10	12
	50	7	9	10
	65	7	8	10
	80	6	7	9
	100	5	6	8
	110	4	5	6
Local Roads * [1]	30	--	11	16
	50	7	10	14
	65	7	9	12
	80	6	8	10
	100	5	6	--
URBAN				
Major Thoroughfares [2]	50	8	9	11
	65	7	8	10
	80	6	7	9
	100	5	6	8
Minor Thoroughfares *	30	9	12	14
	50	9	11	12
	65	9	10	12
	80	7	8	10
	100	6	7	9
	110	5	6	7
Local Streets *	30	--	11	16
	50	7	10	14
	65	7	9	12
	80	6	8	10
	100	5	6	--

* For streets and roads with projected annual average daily traffic less than 250 or short grades less than 150 meters (500 ft) long, grades may be 2% steeper than the values in the above table. (Reference NCDOT Roadway Metric Design Manual, page 1-12 T-3)

[1] Local Roads including Residential Collectors and Local Residential.

[2] Major Thoroughfares other than Freeways or Expressways.

Alleys

1. Alleys shall be required to serve lots used for commercial and industrial purposes except that this requirement may be waived where other definite and assured provisions are mode for service access. Alleys shall not be provided in residential subdivisions unless necessitated by unusual circumstances.

2. The width of an alley shall be at least 6.0 meters.

3. Dead-end alleys shall be avoided where possible, but if unavoidable, shall be provided with adequate turn around facilities at the dead-end as may be required by the Planning Board.

Permits for Connection to State Roads

An approved permit is required for connection to any existing state system road. This permit is required prior to any construction on the street or road. The application is available at the office of the District Engineer of the Division of Highways.

Offsets To Utility Poles

Poles for overhead utilities should be located clear of roadway shoulders, preferably a minimum of at least 9.0 meters from the edge of pavement. On streets with curb and gutter, utility poles shall be set back a minimum distance of 1.8 meters from the face of curb.

Wheel Chair Ramps

All street curbs being constructed or reconstructed for maintenance purposes, traffic operations, repairs, correction of utilities, or altered for any reason, shall provide wheelchair ramps for the physically handicapped at intersections where both curb and gutter and sidewalks are provided and at other major points of pedestrian flow.

Horizontal Width on Bridge Deck

1. The clear roadway widths for new and reconstructed bridges serving 2-lane, two-way traffic should be as follows:

- shoulder section approach:
    - under 800 ADT design year - minimum 8.4 meters width, face to face of parapets or rails, or pavement width plus 3 meters, whichever is greater.
    - 800 - 2000 ADT design year - minimum 10.2 meters width, face to face of parapets or rails, or pavement width plus 3.6 meters, whichever is greater.
    - over 2000 ADT design year - minimum width of 12 meters, desirable width of 13.2 meters width face to face of parapets or rails

- curb and gutter approach:
    - under 800 ADT design year - minimum 7.2 meters face to face of curbs.
    - over 800 ADT design year - with of approach pavement measured face to face of curbs.

- Where curb and gutter sections are used on roadway approaches, curbs on bridges shall match the curbs on approaches in height, in width of face to face curbs, and in

crown drop. The distance from face of curb to face of parapet or rail shall be a minimum of 450 millimeters, or greater if sidewalks are required.

2. The clear roadway widths for new and reconstructed bridges having 4 or more lanes serving undivided two-way traffic should be as follows:

   - shoulder section approach - width of approach pavement plus width of usable shoulders on the approach left and right (shoulder width 2.4 m minimum, 3 m desirable).
   - curb and gutter approach - width of approach pavement measured face to face of curbs.

Table D-6

Exact Metric Equivalents	
English Units	**Metric Units**
1 inch	equals 2.54 centimeters (cm)
1 foot	equals 0.30 meters (m)
1 mile	equals 1.61 kilometers (km)
1 acre	equals 0.40 hectares (ha)

Table D-7

Exact English Equivalents	
Metric Units	**English Units**
1 centimeter (cm)	equals 0.39 inches
1 meter (m)	equals 3.28 feet
1 kilometer (km)	equals 0.62 miles
1 hectare (ha)	equals 2.47 acres

Table D-8

NCDOT Metric Roadway Conversions			
Lane Widths		**Shoulder Widths**	
8 feet	2.4 m	1 foot	0.3 m
9 feet	2.7 m	2 feet	0.6 m
10 feet	3.0 m	4 feet	1.2 m
11 feet	3.3 m	6 feet	1.8 m
12 feet	3.6 m	8 feet	2.4 m
14 feet	4.2 m		

APPENDIX E

Appendix E
Level of Service Definitions

The various levels of service are defined below for uninterrupted flow facilities, but the basic concepts apply to all roads. These levels of service are illustrated in Figure E-1.

LOS A

Represents free flow. Individual users are virtually unaffected by the presence of others in the traffic stream. Freedom to select desired speeds and to maneuver within the traffic stream is extremely high. The general level of comfort and convenience provided to the motorist, passenger, or pedestrian is excellent.

LOS B

Is in the range of stable flow, but the presence of other users in the traffic stream begins to be noticeable. Freedom to select desired speeds is relatively unaffected, but there is a slight decline in the freedom to maneuver within the traffic stream from LOS A. The level of comfort and convenience provided is somewhat less than at LOS A, because the presence of others in the traffic stream begins to affect individual behavior.

LOS C

Is in the range of stable flow, but marks the beginning of the range of flow in which the operation of individual users becomes significantly affected by interactions with others in the traffic stream. The selection of speed is now affected by the presence of others, and maneuvering within the traffic stream requires substantial vigilance on the part of the user. The general level of comfort and convenience declines noticeably in this range.

LOS D

Represents high-density, but stable, flow. Speed and freedom to maneuver are severely restricted, and the driver or pedestrian experiences a generally poor level of comfort and convenience. Small increases in traffic flow will generally cause operational problems at this level.

LOS E

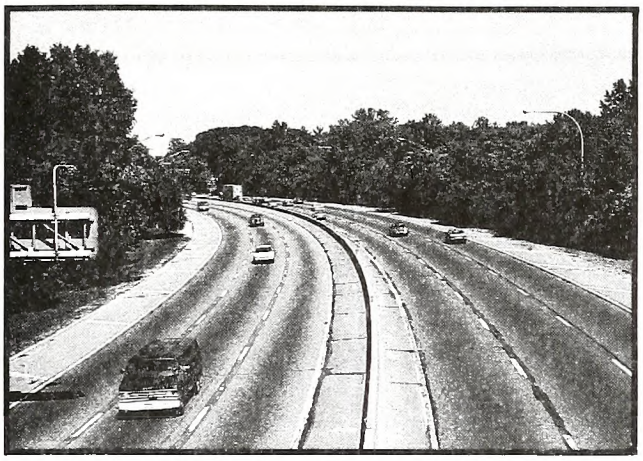
Represents operating conditions at or near the capacity level. All speeds are reduced to a low, but relatively uniform value. Freedom to maneuver within the traffic stream is extremely difficult, and it is generally accomplished by forcing a vehicle or pedestrian to "give way" to accommodate such maneuvers. Comfort and convenience levels are extremely poor, and driver or pedestrian frustration is generally high. Operations at this level are usually unstable, because small increases in flow or minor perturbations within the traffic stream will cause breakdowns.

LOS F

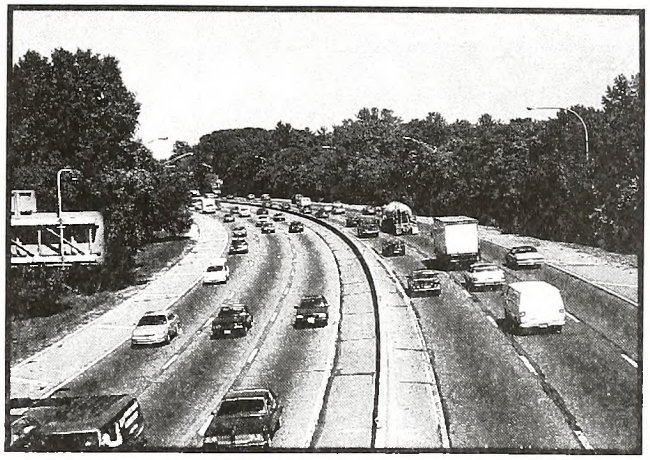
Is used to define forced or breakdown flow. This condition exists wherever the amount of traffic approaching a point exceeds the amount which can traverse the point. Queues

form behind such locations. Operations within the queue are characterized by stop-and-go waves, and they are extremely unstable. Vehicles may progress at reasonable speeds for several hundred feet or more, then be required to stop in a cyclic fashion. Level of Service F is used to describe the operating conditions within the queue, as well as the point of breakdown. It should be noted, however, that in many cases operating conditions of vehicles or pedestrians discharged from the queue may be quite good.

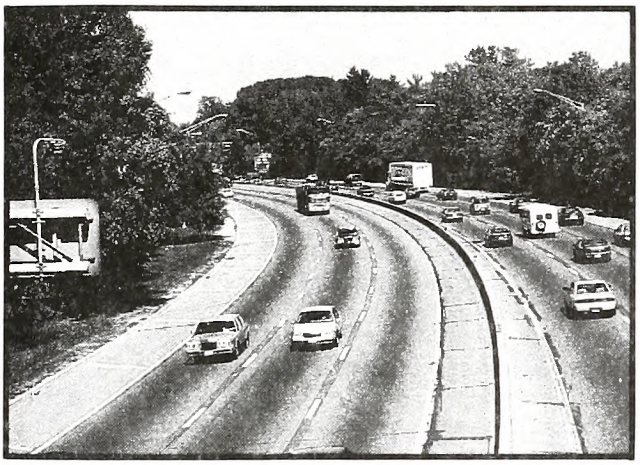
Source: 1994 Highway Capacity Manual



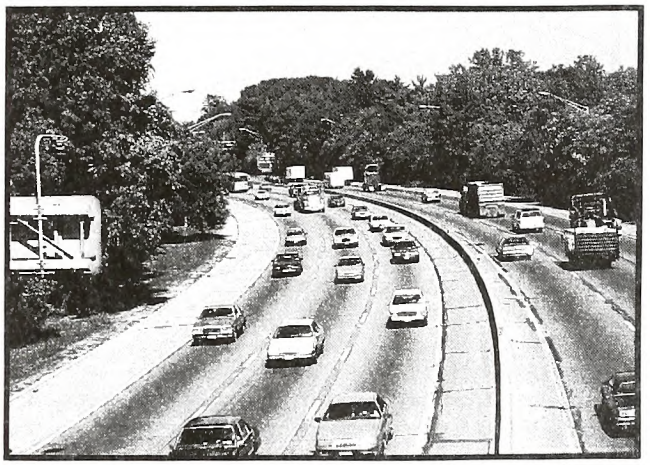
LOS A.



LOS D.



LOS B.



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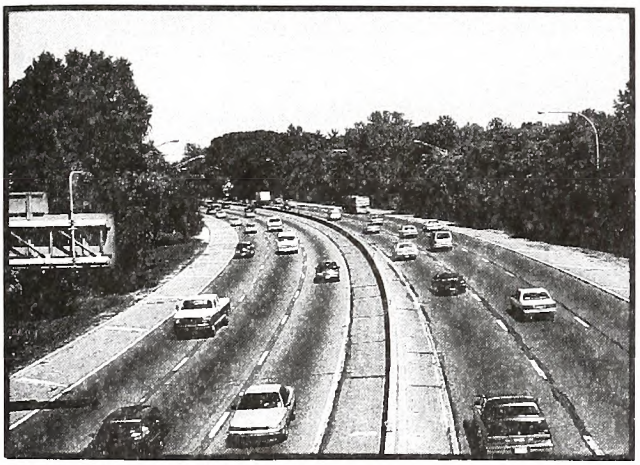

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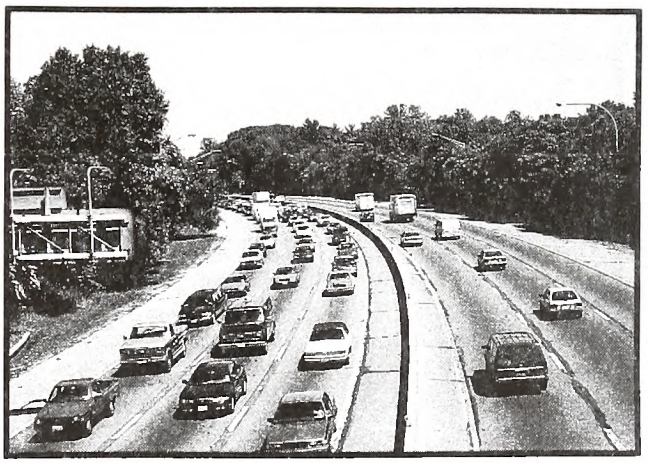

LOS F.

FIGURE E1
LEVELS OF SERVICE

APPENDIX F

Appendix F
Town and Public Involvement

Meetings

The first meeting held with the Town of Grifton was a Planning Board Meeting on September 12, 1996. At this meeting, the board was re-introduced to the thoroughfare planning process that was started back in 1991.

Over the past several years, Grifton has experienced steady growth, but the advent of the North Carolina Global TransPark could have a dramatic effect. With employment projections for the TransPark of up to 25,000 people by the year 2020, Grifton could become a booming bedroom community for this employment center. The Planning Board stated that future residential development would most likely be concentrated around North Highland Boulevard (SR 1939) and Church Street (SR 1907) north of town, NC 118 east of town, and around the neighborhoods west of NC 11 and south of SR 1091. In addition, traffic through the area will increase as the TransPark develops, since NC 11 and NC 118 provide quick and easy routes to northeast North Carolina.

A preliminary plan that was developed in the early 1990's was presented for discussion. The Planning Board supported the idea of a Northern Loop to provide residents with easier access to NC 11 north. They also supported a bypass for NC 118 to the south of the existing route, which would remove a majority of the truck traffic that currently travels through the downtown area. A southern bypass would also provide a more direct route for traffic traveling to and from the proposed TransPark in the future. It was suggested that this route connect to NC 11 at SR 1091, which continues on to Snow Hill. They also requested that SR 1091 be redesignated as an extension of NC 118. Upgrades to Hanrahan Road (SR 1110) were also suggested as this is a heavily used truck route between New Bern and NC 11.

In November, similar introductory information was presented to the Town Board of Commissioners at their monthly work session. The Board of Commissioners supported the southern bypass idea for NC 118 with the understanding that it would be a long-range proposal. They also supported the Northern Loop concept, utilizing either Mashie Drive or Casey Drive in order to avoid relocating any homes. Smaller projects included the widening of North Highlands Boulevard to 24 feet of pavement and widening Hanrahan Road so that trucks would not tear it up so quickly. The Commissioners also supported renaming SR 1091 as NC 118 to provide a logical east-west connection for the towns along the route.

In January of 1997, a Planning Board Meeting was held to present preliminary recommendations for the area. The Board was in general agreement with the plan as presented, which included a Northern Loop connecting NC 118 and North Highlands Boulevard, and a southern bypass for NC 118 connecting to NC 11.

The location of the Northern Loop was discussed at length and included alignments that utilized both Mashie and Casey Drivers, as well as connections with North Highlands Boulevard at South Chebistal Drive, McCotter Drive, and SR 1103. Ultimately, the shortest of the three routes was chosen.

In addition, agreement could not be reached on the best location for the bypass's tie-in with NC 11. As initially proposed, the bypass connected to NC 11 south of SR 1091 to provide a more direct route to the Global TransPark area. However, this connection did not lend itself to the future designation of SR 1091 as an extension of NC 118. It was requested that an additional alignment be studied with this in mind.

Though unanimous agreement was not reached on all parts of the plan, the Planning Board recommended the preliminary plan to the Board of Commissioners.

In April, the Town Board of Commissioners was presented with the recommended plan. Similar issues regarding the location of the Northern Loop and Southern Bypass were discussed. Ultimately, the Commissioners recommended that a modified plan, with the Southern Bypass connecting to NC 11 at SR 1091, be presented to the public for comment.

Public Involvement

On August 12, 1997, a Public Information Workshop was held from 3:00 PM to 7:00 PM at the Grifton Town Hall. The Town Manager and NCDOT Project Engineer were available to answer questions and provide information about the proposed thoroughfare plan. The workshop was advertised in the local paper two weeks prior to its occurrence, and 3 people attended. Concerns included making improvements to Main Street and North Highland Boulevard.

At 7:00 PM that evening, a Public Hearing was held on the Proposed Thoroughfare Plan. There were no public comments on the plan. The Grifton Board of Commissioners officially adopted the plan at this meeting.

On October 3, 1997, the North Carolina Department of Transportation was presented with the Proposed Grifton Thoroughfare Plan for consideration. The plan was mutually adopted at this meeting.